AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE	OF	PAGES
	1		2

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. *(If applicable)*
0006	21 JUNE 2002		

6. ISSUED BY	CODE	7. ADMINISTERED BY *(If other than Item 6)*	CODE
US ARMY ENGINEER DISTRICT, FORT WORTH ATTN: CESWF-CT (RM 2A19) PO BOX 17300 FORT WORTH, TX 76102-0300			

8. NAME AND ADDRESS OF CONTRACTOR *(No., street, county, State and ZIP Code)*	(X)	9A. AMENDMENT OF SOLICIATION NO.
	☒	DACA63-02-R-0013
		9B. DATED *(SEE ITEM 11)* 26 APRIL 2002
	☐	10A. MODIFICATION OF CONTRACT/ORDER NO.
		10B. DATED *(SEE ITEM 11)*
CODE / FACILITY CODE		

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☒ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended, ☒ is not extended.

Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:

(a)By completing items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment your desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA *(If required)*

13. THIS ITEM ONLY APPLIES TO MODIFICATION OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

CHECK ONE	
	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: *(Specify authority)* THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES *(such as changes in paying office, appropriation date, etc.)* SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER *(Specify type of modification and authority)*

E. IMPORTANT: Contractor ☐ is not, ☐ is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (*Organized by UCF section headings, including solicitation/contract subject matter where feasible.)*

The Request for Proposal for Design-Build Harris Heights Family Housing, Fort Sam Houston, Texas, is amended as follows:

See Continuation Sheet.

NOTE: Receipt of Proposal date and time remain 8 JULY 2002 at 4 P.M. local time, as previously announced.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER *(Type or print)*		16A. NAME AND TITLE OF CONTRACTING OFFICER *(Type or print)*	
15B. CONTRACTOR/OFFEROR *(Signature of person authorized to sign)*	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA *(Signature of Contracting Officer)*	16C. DATE SIGNED

Item 14. Continued.

CHANGES TO SPECIFICATIONS

1. Replacement Sections – Replace the following sections with the accompanying new sections of the same number and title, each bearing the notation "ACCOMPANYING AMENDMENT NO. 0006 TO SOLICITATION NO. DACA63-02-R-0013:"

SECTION 01000	DESIGN AND CONSTRUCTION SCHEDULE
SECTION 01001	STATEMENT OF WORK
SECTION 01016	DESIGN DOCUMENT REQUIREMENTS
SECTION 01770	CONTRACT CLOSEOUT

CHANGES TO ATTACHMENTS

2. New Attachment.- Add the following accompanying new attachment bearing the notation “ACCOMPANYING AMENDMENT NO. 0006 TO SOLICITATION NO. DACA63-02-R-0013 and add to the Project Table of Contents:"

ATTACHMENT 16 SUSTAINABLE PROJECT RATING TOOL (SPiRiT)

END OF AMENDMENT

SECTION 01000

DESIGN AND CONSTRUCTION SCHEDULE
[AM#6]

PART 1 GENERAL

1.1 SCHEDULE

Commence, prosecute, and complete the work under this contract in accordance with the following schedule and Section 00700 CONTRACT CLAUSES clauses COMMENCEMENT, PROSECUTION AND COMPLETION OF WORK and LIQUIDATED DAMAGES:

Item of Work	Commencement of Work (calendar days)	Completion of Work (calendar days)	Liquidated Damages per calendar day[1]_ __
(1) Completion of all design and construction work except Establishment of Turf and Landscaping	Within 10 calendar days after receipt of Notice of Proceed	600	$800.00
(2) Establishment of Turf	*	*	---
(3) Landscaping	**	**	---

[1]NOTES:

a. The Contract duration stated above for Work Item 1 is the maximum. Upon Contract Award, the Contractor's proposed duration as stated on the Price Proposal Schedule shall become the contract duration for this Work Item unless it exceeds the maximum duration stated above. The liquidated damages stated above will be applied for each calendar day the Contractor exceeds the Contract duration schedule.

b. See Section 01015 DESIGN REQUIREMENTS AFTER AWARD, paragraph "SUBMISSION OF CONSTRUCTION DRAWINGS, SPECIFICATIONS, AND DESIGN ANALYSES," concerning submission of construction documents and Section 01000 paragraph, "SEQUENCE OF DESIGN/CONSTRUCTION," concerning start of construction.

c. For construction planning purposes Government review time for review submittals (100% site and utility and 60% buildings design, and 100%

buildings design) is specified in 01015 DESIGN REQUIREMENTS AFTER AWARD.

d. Delay in completion of design will not be considered as a valid reason to delay completion of entire work.

*Establishment of Turf

Planting and maintenance for turfing shall be in accordance with Contractor's Section for TURFING . No payment will be made for establishment of turf until all requirements of the section are adequately performed and accepted, as determined by the Contracting Officer.

**Landscaping

Planting and maintenance for landscaping shall be in accordance with Contractor's Section for LANDSCAPING. No payment will be made for landscaping until all requirements of the section are adequately performed and accepted, as determined by the Contracting Officer.

1.1.1 Testing of Heating and Air-Conditioning Systems

The times stated for completion of this project includes all required testing specified in appropriate specification sections of heating, air conditioning and ventilation systems including HVAC Commissioning. Exception: boiler combustion efficiency test, boiler full load tests, cooling tower performance tests, and refrigeration equipment full load tests, when specified in the applicable specifications, shall be performed in the appropriate heating/cooling season as determined by the Contracting Officer.

1.2 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER (OCT 1989) (ER 415-1-15)(52.0001-4038 1/96)

a. This provision specifies the procedure for determination of time extensions for unusually severe weather in accordance with the contract clause entitled "Default: (Fixed Price Construction)." In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

(1) The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

(2) The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the contractor.

b. The following schedule of monthly anticipated adverse weather delays due to precipitation and temperature is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities. Wind is not considered in the Monthly Anticipated Adverse Weather Calendar Day Schedule.

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY
WORK DAYS BASED ON (5) DAY WORK WEEK

SAN ANTONIO, TX AREA (FORT SAM HOUSTON, KELLY, LACKLAND, BROOKS, AND RANDOLPH AFB'S AND RESERVE CTRS AT SAN ANTONIO)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
4	3	3	2	4	4	1	1	3	2	2	3

c. Upon acknowledgment of the Notice to Proceed (NTP) and continuing throughout the contract, the contractor will record on the daily CQC report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the contractor's scheduled work day.

The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in paragraph "b", above, the Contracting Officer will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the contract clause entitled "Default (Fixed Price Construction)."

1.3 WORK RESTRICTIONS

1.3.1 Working Hours

Normal working hours are Monday through Friday, 0700 to 1800 hours.

1.3.2 Security Requirements

For the duration of this Contract, access to the Installation may be delayed between 30 minutes to an hour or more due to security precautions, including the checking of vehicle occupants' IDs, vehicle manifests, and the searching of all vehicles.

1.4 UTILITIES

1.4.1 Payment for Utility Services (FAR 36.303(C)(6))

In accordance with Contract Clause 52.236.14 AVAILABILITY AND USE OF UTILITY SERVICES, water and electricity are available from Government-owned and operated systems and will be furnished without charge to the Contractor. Gas is available from City of San Antonio owned and operated systems; arrangements for use and payment shall be made with the City.

1.4.2 Outages

The Contractor shall coordinated all requests for utility outages with the Contracting Officer and local utility provider (where applicable) in writing 14 days prior to date of requested outage:

a. Water, gas, steam, and sewer outages shall be held to a maximum duration of 4 hours unless otherwise approved in writing.

b. Electrical outages shall have a maximum duration of 4 hours.

1.4.3 Coordination

a. The Contractor shall coordinate with San Antonio City Public Services (CPS) on the design and construction of gas lines to the building. CPS will provide gas service up to and including the meter. Contractor is responsible for design and construction within the building up to the meter. All fees and costs for the CPS work will be paid by the Contractor.

[AM#6]
1.4.4 Contractor Telephone Service

Coordinate with ITBC and the local phone company for contractor telephone service during construction.

1.5 STREET CLOSINGS

The Contractor shall coordinate all requests for street closings with the Contracting Officer in writing 14 days prior to date of requested outage:

a. One lane traffic shall be maintained at all times (except that a total closing may be allowed for specific 8-hour periods).

b. The final street repair shall be completed within 14 days after the start of any street crossing. Any part of the street returned to service prior to final repair shall be maintained smooth with hot-mix cold-lay surface course.

1.6 SEQUENCE OF DESIGN/CONSTRUCTION

(a) After receipt of the Contract Notice to Proceed (NTP) the Contractor shall initiate design, comply with all design submission requirements as covered under Division 01 General Requirements, and obtain Government review of each submission. No construction may be started, [with the exception of clearing, etc, until the Government reviews the Final Design submission and determines it satisfactory for purposes of beginning construction. The Contracting Officer will notify the Contractor when the design is cleared for construction. The Government will not grant any time extension for any design resubmittal required when, in the opinion of the Contracting Officer, the initial submission failed to meet the minimum quality requirements as set forth in the Contract.

(b) If the Government allows the Contractor to proceed with limited construction based on pending minor revisions to the reviewed Final Design submission, no payment will be made for any in-place construction related to the pending revisions until they are completed, resubmitted and are satisfactory to the Government.

(c) No payment will be made for any in-place construction until all required submitttals have been made, reviewed and are satisfactory to the Government.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section --

STATEMENT OF WORK

1. DESIGN OBJECTIVES.

1-1 The design and construction shall comply with the specifications and requirements contained in this Request for Proposals (RFP). The design and technical criteria contained and cited in this RFP establish minimum standards for design and construction quality. All housing units constructed in accordance with these standards are "Energy Star Homes".

1-2 Work Scope. The objective of this solicitation is to obtain housing complete and adequate for assignment as quarters for military personnel and their families. This contract shall consist of the design and construction of a total of **70 senior and junior noncommissioned officer** housing units**, parking, roads and site amenities (AM#4)** on Government-owned land at **Fort Sam Houston, Texas**, which comply with this RFP. Work shall consist of the following:

1-2.1 Housing Units. Housing units with patio or balcony, **carport (AM#4)**, exterior storage, individual central heating systems, energy conservation systems and central air conditioning, and including the following Contractor-furnished/Contractor-installed (CF/CI) equipment and appliances: range, refrigerator, garbage disposal, dishwasher, water heater, carbon monoxide alarms, and smoke detectors. **The 20 SrNCO units are to be sited together. The 50 JrNCO units are to be sited together. SrNCO and JrNCO units are not to be mixed amongst each other. The exception to this are the accessible housing units mentioned in paragraph 1-2.2. (AM#4)** Housing units shall be a mix of three- and four- bedroom housing units as shown in Table 1-1:

TABLE 1-1 - HOUSING UNITS

Pay Grade	Number of Bedrooms	Number of Units
E-7 through E-9 (SNCO)	3	20 units
E-1 through E-6 (JNCO)	4	50 units

1-2.2 Accessible units. No less than five (5) percent of the units shall be handicapped accessible. This would result in a minimum of one (1) Sr. NCO unit and three (3) Jr. NCO units being handicapped accessible. These housing units shall be designed and built in such a way that they may be easily and readily modified to accommodate physically challenged occupants at time of occupancy. Design of accessible housing units shall conform to the Uniform Federal Accessibility Standards (UFAS) and American Disabilities Act Accessibility Guidelines (ADAAG). Accessible housing units shall be located at the northern portion of the site bound by Patch, Chaffee and W.W. White Roads (north of unit 881 and east of units 831 to 834). The requirement to have an additional two (2) percent of housing units equipped with warning devices for the hearing and visually impaired will be met at the time the unit is assigned to an occupant needing this equipment.

1-2.3 Site area and density.

1-2.3.1 Site area. The site/s is/are described on the RFP drawings included as part of this solicitation and includes approximately 17.2 hectares [42.6 acres]. Site work includes all design and construction of the site design to include grading, storm drainage, erosion control, pedestrian and vehicular circulation, utility systems, outdoor lighting, play lots and physical security.

1-2.3.2 Site density. This project consists of 70 housing units on **7.1 hectares [17.7 acres] of land area (AM#5)**. The project site is approved for **LOW DENSITY** siting. Site development shall comply with the minimum requirements for **LOW DENSITY** siting. The new housing area will be constructed on the site located

along the eastern boundary of the existing Patch-Chaffee housing area. The site is bound on the north by Hardee Road and to the south by Wilson Street. **For construction purposes, the southern boundary will be Taylor Street. Chaffee Road (AM#4)** and Forage Avenue encompass the western and eastern boundaries, respectively for the construction of new homes. An additional area at the northwest corner of the Allen Road/Patch Road intersection can be developed as green space, as needed. **The existing playground located between Patch and Chaffee Roads and Crockett and Lawton Roads will remain. (AM#4)** The southern portion of the site (between Road S-23, Wilson Street and Taylor Street) used to house an aircraft maintenance shop and other industrial facilities and has been determined to be a contaminated site. This area shall not be developed for new construction. Refer to paragraph 14- ENVIRONMENTAL for additional information.

1-2.4 Special utilities and supplementary construction. If OPTION 1- Ground Coupled Heat Pumps, is selected, site gas distribution is not required.

1-2.4.1 Waste Area. Waste material, except for **regulated** asbestos containing material, shall be disposed of by the Contractor. Disposal area shall be located off Government controlled property, at the Contractor's expense and responsibility.

1-2.4.2 Haul Routes. See the Project Location Map in the RFP drawings.

1-2.4.3 Bench Marks. See the topographic maps in the RFP drawings.

1-2.4.4 Contractor's Staging Area and Storage Yard. A Contractor's storage area and storage yard shall be located within the project boundaries, as described in paragraph 1-2.3.2 above and as directed by the Contracting Officer.

1-2.4.5 Security Fencing. A 1.83 m (6 ft) high temporary chain link construction fence **(AM#5)** shall be installed and maintained around the construction site (including the staging area and storage yard) during construction for security and the safety of children, pedestrians and others living nearby. This fencing shall remain in place for the duration of the contract. Stored materials, equipment and construction trailers shall be located within the staging area and storage yard.

1-2.5 Demolition considerations and requirements. Demolition will consist of any utilities and/or subsurface structures (i.e. foundations, piers) that have been abandoned in place and which fall within the boundaries of new construction and existing roads and curb and gutter, as needed, to construct the proposed design. **Replace Road No. S-23 between Lawton and Crockett Roads. Replace the street located one block east of Road No. S-23, between Harney and Schofield Roads. This street may be rerouted, as deemed necessary. (AM#4)** Utility systems and streets must be demolished in such a manner as to maintain active service and vehicular circulation to the existing housing area. Existing maps indicate that several buildings and a swimming pool once existed on the site between Crockett and Wilson Roads and between Road No. S-23 and Forage Road. These areas shall be thoroughly investigated to determine the extent and/or presence of subsurface structures that may have been abandoned in place and will require removal before construction. The approximate location of the swimming pool has been identified on the topographic maps included in the RFP. See paragraph 14- ENVIRONMENTAL for environmental demolition concerns that may be encountered.

1-3 Energy Star Homes Program Requirements: The Contractor, at the direction of the USACE Contracting Officer's Representative, shall be required to submit to the EPA the necessary information and certifications to register the units constructed in this project as Energy Star Homes. The contractor constructing housing units in accordance with this Statement of Work is not required to be a registered Energy Star Contractor. The required information can be submitted to EPA in several methods:

1-3.1 Through the Internet by clicking on the *certificate automation system* icon at the World Wide Website http://yosemite.epa.gov/appd/eshomes/eshomes.nsf and following the instructions

1-3.2 By emailing to certificates@epa.gov

1-3.3 By mailing to the EPA Customer Service Manager (address & tel. no. below):

The following information needs to be submitted for each home [note: homes can be submitted *individually* (each home individually tested/rated) or in a "*batch*" (for batches of homes, particular unit types). The following data should be provided for each home (note: this can be in the form of a spreadsheet, database, word processing file or email; if the format changes in the future EPA will inform the contractor of the changes):

Contractor company name (ex. Jones Construction Co.)
Contractor telephone number (ex. 703-123-4567)
Name of company/organization performing testing/rating (ex. Jones Construction Co.)
Telephone number of company/organization performing testing/rating (ex. 703-123-4567)
Street address of home being submitted, including city, state & zip code (ex. 123 Smith St., City, State 12345)
Type of verification:

"**FEP**" --- if this particular home underwent infiltration testing (and possibly duct leakage testing). Please list the tested infiltration value in ACH/nat (natural air changes per hour) and if tested, the duct leakage to nonconditioned spaces in cfm and % of air handler flow at a pressure of 25 pascals.

SEP" --- if this particular home did *not* undergo infiltration and/or duct leakage testing, but was a member of a batch out of which at least 15% DID; if so, then the address of a home that was a tested member of this batch should also be identified as the tested member of the batch.

1-3.4 The following statement: "This home qualifies as an EPA Energy Star Home by conforming to the residential energy efficiency specifications and quality control confirmation of U.S. Army Corps of Engineers TI 801-02, Family Housing, **01-/Oct-/01 (AM#4),** which has been determined by the EPA and USACE to be an ***Equivalent Program*** to the EPA Energy Star Homes Program." In addition, the "checklist" of home specifications that the USACE Contracting Officer's Representative uses to ascertain if the TI 801-02 specifications and testing results were met should be submitted. The statement and checklist should have the USACE Contracting Officer's Representative's signature affixed.

The year the house was built (ex. 2001)
The year the house was submitted for Energy Star certification (ex. 2001)
The name and title/rank, mailing address, email address, telephone number and fax number of the USACE Contracting Officer's Representative overseeing the contractor's adherence to construction specifications, quality control of construction and testing/rating activities.

1-3.5 The Contractor will make arrangements with the EPA for receipt of the "Energy Star Homes" certificates and unit plaques and shall provide the certificates to the USACE Contracting Officer's Representative and include in the project the installation of the plaques on each of the housing units. Coordination point with the EPA regarding Energy Star certification and plaques shall be as follows:

United States Environmental Protection Agency
Climate Protection Division
US EPA 6202J
Washington DC 20460
ENERGY STAR Homes Customer Service Manager
ATTN: Mr. Brian Ng, Ng.Brian@epa.gov, 202-564-9162, fax: 202-565-2079
http://www.energystar.gov/homes

Technical questions on the Energy Star Homes Program in general can be addressed to:

ENERGY STAR Homes Technical Coordinator
ATTN: Mr. Glenn T. Chinery, Chinery.Glenn@epa.gov, 202-564-9784, fax: 202-565-2079

1-4 Design Freedom. Requirements stated in this RFP are **minimums**. Innovative, creative, or cost-saving proposals which meet or exceed these requirements are encouraged. Existing housing plans or modifications thereof that meet the design and construction criteria specified herein, which an offeror has previously constructed and priced, may be submitted. They may include designs incorporating factory fabricated

components or modules. Deviations from space and adjacency requirements are discouraged unless the changes result in improvement to the facilities.

1-5 Housing Units. Site-built, factory-built units are acceptable options for this project.

1-6 Definition of Housing Unit Types. Terms for housing unit types used in these criteria are defined as follows:

1-6.1 Site-built housing. A residential building or housing unit wholly or substantially constructed at the site.

1-6.2 Factory-built housing. Construction consisting of components, sub-assemblies such as modules, panelized walls, roof trusses, floor joists, and other factory-assembled components, which are transported to the construction site and further assembled into completed housing units. All interior and exterior walls, regardless of whether they are structural (load bearing) or not, are plant fabricated (panelized). Panels must be fabricated to the extent that the structure of the panel or truss is factory-assembled. Finishes such as interior wall board may be site applied.

1-6.3 Deleted

1-6.4 Deleted

1-6.5 Deleted

1-6.6 Duplex. One or two-story housing units joined together by a common party wall and each housing unit entered directly from the exterior.

1-6.7 Deleted

1-6.8 Detached house. A single-family housing unit which is not attached to another housing unit.

1-7 Design Quality. The objectives are to obtain housing structures and complimentary site development within funds available and to optimize livability. Design quality is achieved through the optimization of interior planning, integration of housing structures to the site, and balancing architectural attractiveness, variety, function, and design for low-cost maintenance and operation. Offerors should consider sustainable design applications, as described in paragraph 13, in developing proposals.

1-8 Installation Real Property Master Plan. The installation real property master plan provides comprehensive documentation of the existing conditions of natural, man-made, and human resources. It also guides the future land-use development. The real property master plan should be consulted as it is the mechanism for ensuring that individual projects are sited to meet overall installation goals and objectives for land use development

1-9 Installation Design Guide. Design of this project shall incorporate the design guidance and criteria contained in the Installation Design Guide, excerpts of which are contained in VOLUME IV, ATTACHMENTS .

1-10 Energy and Resources Conserving Features. Public Law 102-486, Executive Order 13123, and Federal Regulations 10 CFR 435, require Federal buildings to be designed and constructed to reduce energy consumption in a life-cycle, cost-effective manner using renewable energy sources when economical. Products designed to conserve energy and resources by controlling the amounts of consumed energy or by operating at increased efficiencies should be considered. Minimum requirements for this project are High-efficiency central air conditioning and/or heating units, setback thermostats, and water flow-limiting plumbing fixtures. Offerors are required to provide Energy and Resource conserving improvements that at least insure compliance with the Energy Star Homes Program parameters.

1-11 Prototype Housing Units. The purpose of the prototype housing unit is to verify the details of the approved design and material selections, and to establish the quality level against which the remaining work

will be judged. At the plant, or at the site, construction connection details shall be exposed for study by authorized Government inspectors for a period of time agreed to by the Contractor and the Contracting Officer. The housing unit or units at the plant and/or the prototype at the site are subject to Contracting Officer's approval. At the site, the complete prototype shall be constructed for each housing unit type. Each stage of work shall be completed and accepted on the prototype prior to starting work on the same stage for similar housing units in the project.

1-11.1 "Site-Built." A prototype housing unit shall be required for each housing unit type.

1-11.1.1 Where multiple prototype units are being constructed, one or two prototype units shall be left in the “rough in” stage (no interior finishes) so that the utility systems and framing construction is exposed. Exteriors of these prototypes shall be completely finished. When the last new units are constructed, these “rough in” stage prototype units shall be completed and turned over to the Government with the last turn-over group.

1-11.2 "Factory-Built." A prototype housing unit shall be required for each housing unit type of each run fabricated at the plant for manufactured or factory-built homes.

1-11.3 Deleted

1-11.4 Factory-Built. If the housing units are classified as factory-built housing, all wall panels which are fabricated in the plant for shipment to the site shall have prototype units constructed and assembled for in-plant inspection by the Government. This shall include, as a minimum, wall framing, roof and ceiling framing, connection details, utility piping, wiring and ductwork, interior and exterior wall finishes which form part of the factory-built wall. In addition, the Contractor shall construct as part of the factory-built prototype, installed samples of wall insulation, finished siding (if not part of wall assembly), sample installed bathtub and sink and installed kitchen sink and cabinets to demonstrate proper installation and wall connections. Portions of the work shall be left unfinished or exposed to demonstrate interior construction details.

1-11.4.1 One Floor Prototype. If only one floor of the prototype is factory-built, factory assembly of the factory-built portion of the prototype is required. In all cases, the factory prototype shall consist of one of each building type. The factory prototype shall be assembled to verify assembly connections, details, construction, and transportation of the finished housing unit.

1-11.4.2 Structural Integrity. Manufactured and factory-built homes shall be of individual housing units attached to one another in a manner which shall provide a finished structural assembly having an appearance and structural integrity comparable to a site-built single or multi-family residence built to applicable codes.

1-11.4.3 Construction Tolerances. Assembled housing units shall be true and plumb and all within specified construction tolerances for all alignments represented on the drawings. Adjacent walls shall be attached at roof and floor levels in such a manner as to preclude placing any wood member in cross-grain bending or cross-grain tension, and to avoid putting nails in withdrawal.

1-12 Deleted

2. CRITERIA REFERENCES.

2-1 Criteria to be used for design and construction shall be taken from the most current references at the date of issue of the RFP. Administrative, contractual, procedural, and environmental features of the contract shall be as described in other sections of the RFP. Referenced codes and standards herein and those listed below are minimum acceptable criteria.

2-2 Local and State Codes or Standards. The following specifications, standards, bulletins, and handbooks form a part of this document to the extent specified herein. **(AM#4)**

2-2.1 Local. Fort Sam Houston **Installation** Design Guide. ETL 1110-3-491 SUSTAINABLE DESIGN FOR MILITARY FACILITIES.

2-2.2 State.

2-3 Federal Laws. The Federal laws and regulations listed in Table 2-1 form a part of this document. They are available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20401-9325 (202) 512 - 1800

TABLE 2-1 – FEDERAL LAWS & REGULATIONS

CFR/USC No.	Description
P.L. 102-486	Energy Policy Act of 1992
10 CFR 430	National Appliance Energy Conservation Act (NAECA)
10 CFR 435	Voluntary Performance Standards for New Commercial and Multi-Family High Rise Residential Buildings; Mandatory for Federal Buildings.
10 CFR 436	Methodology and Procedures for Life Cycle Cost Analyses
16 CFR 1630	Standard for Surface Flammability of Carpet and Rugs
40 CFR 247.12	Comprehensive Procurement Guideline for Products Containing Recovered Materials, Construction Products
40 CFR 280	Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks
49 CFR 192	Transportation of Natural Gas and Other Gas by Pipeline: Minimum Federal Safety Standards
49 CFR 195	Transportation of Hazardous Liquids by Pipeline
24 USC 5301	Public Law 93-383, Community Development
42 USC 4321-4361	National Environmental Policy Act (NEPA)

TABLE 2-1 – FEDERAL LAWS & REGULATIONS	
CFR/USC No.	Description
42 USC 4901-4918 & 49 USC 1431	Noise Control Act of 1972
Army Regulation 200-1	Environmental Protection and Enhancement, May 1990
E.O. 13123	Energy Efficiency and Water Conservation in Federal Facilities

2-4 Federal Specifications and Standards. The specifications listed form a part of this document to the extent specified herein. Federal Standard 795, Uniform Federal Accessibility Standards, and federal specifications are available from the Commanding Officer, Naval Publications and Forms Center, ATTENTION: NPODS, 5801 Tabor Avenue, Philadelphia, PA 19120-5099.

2-5 Other Government Documents and Publications. The following Government documents and publications form a part of this document to the extent specified herein:

2-5.1 Americans With Disabilities Act Accessibility Guidelines, are available from U.S. Architectural and Transportation Barriers Compliance Board, 1331 F Street, N.W., Washington, D.C. 20004-1111

2-5.2 Federal Emergency Management Agency, Mitigation Directorate; 500 C Street, SW; Washington DC 20472: National Performance Criteria for Tornado Shelters and FEMA 320, Taking Shelter from the Storm: Building a Safe Room Inside Your Home. http://www.fema.gov/

2-5.3 NBS Handbook 135, Life-Cycle Costing Manual for the Federal Energy Management Program. Available from the National Institute of Science and Technology, formerly National Bureau of Standards (NBS).

2-5.4 Standard for the Surface Flammability of Carpets and Rugs; and (Unnumbered) Handbook for Public Playground Safety, CFR 16-1630. Available from the Consumer Product Safety Commission, Directorate for Compliance and Administrative Litigation, Department of Regulatory Development, Washington, DC 20207, (301) 492-0626 or 492-0400.

2-5.5 United States Environmental Protection Agency criteria are available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161, (703) 487-4650: EPA/600/8-88/087, Radon-Resistant Residential New Construction; EPA/625/5-88/024, Application of Radon Reduction Methods; and EPA/625/5-87/019, Radon Reduction Techniques for Detached Houses.

2-6 Non-Government Publications. The following publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are Department of Defense (DoD) adopted are those listed in the Department of Defense Index of Specifications and Standards (DODISS).

2-6.1 Air Conditioning Contractors of America, Inc. (ACCA). 1712 New Hampshire Ave. NW. Washington DC 20009; (202) 483-9370; FAX (202) 588-1217; http://www.acca.org/.

2-6.2 Air-Conditioning and Refrigeration Institute (ARI). Information listed below is available from ARI, 4301 Fairfax Dr., Suite 425, ATTN: Pubs Dept.,Arlington, VA 22203, Ph: 703-524-8800, Fax: 703-528-3816, Internet E-Mail: ari@dgsys.com, Directory of Certified Unitary Air Conditioners, Unitary Heat Pumps and Sound Rated Outdoor Unitary Equipment; ARI 210/240, Unitary Air Conditioning and Air-Source Heat Pump Equipment: http://www.ari.org/

2-6.3 AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA), AMCA 210, Laboratory Methods of Testing Fans For Rating, is available from AMCA, 30 West University Drive, Arlington Heights, IL 60004, (312) 394-0150: http://www.amca.org/

2-6.4 American Architectural Manufacturers Association (AAMA). AAMA specifications shown in Table 2-2 are available from AAMA, 1540 East Dundee Rd., Suite 310, Palatine, IL 60067-8321,Ph: 708-202-1350,Fax: 708-202-1480 2700 River Road, Suite 118, Des Plaines, IL 60018, (312) 699-7310.

TABLE 2-2 - AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION SPECIFICATIONS

No.	Description
AAMA 101	Voluntary Specification for Aluminum Prime Windows and Sliding Glass Doors
AAMA 101V	Voluntary Specification for Poly (Vinyl Chloride) (PVC) Prime Windows and Sliding Glass Doors
AAMA 1002.10	Voluntary Specifications for Aluminum Insulating Storm Products for Windows and Sliding Glass Doors
AAMA 1402	Standard Specifications for Aluminum Siding, Soffit, and Fascia

2-6.5 American Gas Association (AGA). Standards and specifications are available from AGA, 1515 Wilson Blvd., Arlington, VA 22209, Ph: 703-841-8556,Fax: 703-841-8406: http://www.aga.org/

2-6.6 American National Standards Institute, Inc. (ANSI). Copies of the standards listed in Table 2-3 are available from ANSI, 11 West 42nd St., New York, NY 10036, Ph: 212-642-4900, Fax: 212-302-1286: http://www.ansi.org/

TABLE 2-3 - AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) STANDARDS

Std. No.	Std. Description
A112.19.1	Enameled Cast Iron Plumbing Fixtures
A112.19.2	Vitreous China Plumbing Fixtures (DoD Adopted)
A112.19.3	Stainless Steel Plumbing Fixtures (Designed for Residential Use)
A112.19.4	Porcelain Enameled Formed Steel Plumbing Fixtures (DoD Adopted)

TABLE 2-3 - AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) STANDARDS

Std. No.	Std. Description
A112.19.5	Trim for Water-Closet Bowls, Tanks, and Urinals (Dimensional Standards) (DoD Adopted)
A161.1	Recommended Construction and Performance Standards for Kitchen and Vanity Cabinets
B16.5	Steel Pipe Flanges and Flanged Fittings (DoD Adopted)
B16.22	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings (DoD Adopted)
B16.26	Cast Copper Alloy Fittings for Flared Copper Tubes (DoD Adopted)
B31.8	Gas Transmission and Distribution Piping Systems
C2	National Electrical Safety Code
ANSI C105 AWWA A21.5	Polyethylene Encasement for Ductile-Iron Pipe Systems
Z21.10.1	Water Heaters, Gas, Volume I, Storage Type, 75,000 BTUH Input or Less
Z21.45	Flexible Connectors of Other Than All-Metal Construction for Gas Appliances
Z60.1	American Standard for Nursery Stock
Z124.1	Plastic Bathtub Units
Z124.2	Plastic Shower Receptors and Shower Stalls

2-6.7 American Plywood Association. APA B840-K-88, 303 Siding Manufacturing Specifications, are available from the American Plywood Association, P.O. Box 11700, Takoma, WA 98411, (206) 565-6600.

2-6.8 American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) documents, listed in Table 2-4, are available from ASHRAE,1791 Tullie Cir., NE, Atlanta, GA 30329-2305, Ph: 404-636-8400 Fax: 404-321-5478 1791 Tullie Circle, N.E., Atlanta, GA 30329, (404) 636-8400: http://www.ashrae.org/

TABLE 2-4 – AMERICAN SOCIETY OF HEATING, REFRIGERATION, AND AIR-CONDITIONING ENGINEERS (ASHRAE)

No.	Description
ASHRAE -	Handbook of Fundamentals
ASHRAE -	Residential Cooling Load Calculations
ASHRAE 62	Ventilation for Acceptable Indoor Air Quality

TABLE 2-4 – AMERICAN SOCIETY OF HEATING, REFRIGERATION, AND AIR-CONDITIONING ENGINEERS (ASHRAE)

No.	Description
ASHRAE 52	Method of Testing Air Cleaning Devices used in General Ventilation for Removing Particulate Matter
ASHRAE 111	Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air Conditioning, and Refrigeration Systems

2-6.9 American Society of Mechanical Engineers (ASME). ASME B16.11, Forged Fittings, Socket-Welding and Threaded, and ASME B31.8, Gas Transmission and Distribution Systems, are available from ASME, 22 Law Dr., Box 2300, Fairfield, NJ 07007-2900, Ph: 800-843-2763, Fax: 201-882-1717: http://www.asme.org/

2-6.10 American Society of Sanitary Engineers (ASSE). ASSE 1006, Residential Use (Household) Dishwashers, and ASSE 1008, Food Waste Disposal Units, Household, are available from ASSE, AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE), P.O. Box 40362, Bay Village, OH 44140, Ph: 216-835-3040, Fax: 216-835-3488:

2-6.11 American Society for Testing and Materials (ASTM). ASTM specifications listed in Table 2-5 are available from ASTM, AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
1916 Race St., Philadelphia, PA 19103, Ph: 215-299-5585, Fax: 215-977-9679: http://www.astm.org/

TABLE 2-5 - AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) SPECIFICATIONS

Spec. No.	Spec. Description
A53	Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
A526	Specification for Steel Sheet Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality (DoD Adopted)
B117	Method of Salt Spray (Fog) Testing (DoD Adopted)
C90	Specification for Hollow Load-Bearing Concrete Masonry Units (DoD Adopted)
C216	Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale) (DoD Adopted)
D3676	Rubber Cellular Cushion Used for Carpet or Rug Underlay
D1557	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft 2700kN-m/m)
D1785	Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120 (DoD Adopted)

TABLE 2-5 - AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) SPECIFICATIONS

Spec. No.	Spec. Description
D2513	Standard Specification for Thermoplastic Gas Pressure Piping (DoD Adopted)
D2683	Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing (DoD Adopted)
D2846	Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot and Cold-Water Distribution Systems (DoD Adopted)
D3018	Specification for Class A Asphalt Shingles Surfaced with Mineral Granules (DoD Adopted)
D3679	Specification for Rigid Poly (Vinyl Chloride) (PVC) Siding
E84	Standard Test Method for Surface Burning Characteristics of Building Materials (DoD Adopted)
E90	Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions (DoD Adopted))
E108	Standard Methods of Fire Tests of Roof Coverings
E119	Standard Methods of Fire Tests of Building Construction and Materials
E162	Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source (DoD Adopted)
E283	Standard Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors
E330	Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
E336	Standard Test Method for Measurement of Airborne Sound Insulation in Buildings
E547	Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential
E648	Critical Radiant Flux of Floor-Covering Systems Using a Radiant Energy Source
E779	Measuring Air Leakage by the Pressurization Method
E1007	Standard Test Method for Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures
E1465	Standard Guide for Radon Control Options for the Design and Construction of New Low-Rise Residential Buildings

TABLE 2-5 - AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) SPECIFICATIONS

Spec. No.	Spec. Description
F1292	Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment
E1423	Standard Practice for Determining the Steady State Thermal Transmittance of Fenestration Systems
E 1554	Determining External Air Leakage of Air Distribution Systems by Fan Pressurization.
F 1066	Standard Specification for Sheet Vinyl Composition Floor Covering
F1487-98	Standard Consumer Safety Performance Specification for Playground Equipment for Public Use
G90	Standard Practice for Performing Accelerated Outdoor Weathering of Nonmetallic Materials Using Concentrated Natural Sunlight

2-6.12 American Water Works Association, Inc. (AWWA). Specifications listed below are available from AWWA, 6666 West Quincy, Denver, CO 80235, Ph: 800-926-7337, Fax: 303-795-1989, AWWA C500, Gate Valves for Water and Sewerage Systems (DoD adopted); AWWA C502, Dry-Barrel Fire Hydrants; and AWWA C503, Wet-Barrel Fire Hydrants: http://www.awwa.org/

2-6.13 Associated Air Balance Council (AABC). AABC MN-1, National Standards for Total System Balance, is available from AABC, 1518 K St., NW, Washington, DC 20005, Ph: 202-737-0202, Fax: 202-638-4833: http://www.aabchq.com/

2-6.14 American Association of Textile Chemists and Colorists (AATCC). AATCC 134, Electrostatic Propensity of Carpets, is available from AATCC, P.O. Box 12215, Research Triangle Park, NC 27709, (919) 549-8141.: http://www.aatcc.org/

2-6.15 Builders Hardware Manufacturers Association, Inc. (BHMA). Specifications shown in Table 2-6 are available from the Builders Hardware Manufacturers Association, Inc. (BHMA), 355 Lexington Ave., New York, NY 10017, Ph: 212-661-4261, FAX: 212-370-9047.

TABLE 2-6 - BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA) SPECIFICATIONS

No.	Description (Specs. are DoD Adopted)
ANSI/A156.1	Butts and Hinges
ANSI/A156.4	Door Controls, Closers
ANSI/A156.5	Auxiliary Locks and Associated Products
ANSI/A156.2	Bored and Preassembled Locks and Latches

TABLE 2-6 - BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA) SPECIFICATIONS

No.	Description (Specs. are DoD Adopted)
ANSI/A156.12	Interconnected Locks and Latches

2-6.16 Building Officials & Code Administrators International, Inc. (BOCA). The BOCA National Building Code is available from Building Officials & Code Administrators International, Inc., (BOCA), 4051 W. Flossmoor Rd., Country Club Hills, IL 60478-5795, Ph: 708-799-2300, Fax: 708-799-4981: http://www.boca.org/

2-6.17 Carpet and Rug Institute (CRI). CRI Standard for Installation of Commercial Textile Floor Covering Materials, CRI 104, is available from the Carpet and Rug Institute, 310 Holiday Ave. P.O. Box 2048, Dalton, GA 30722-2048, Ph: 706-278-0232: http://www.carpet-rug.com/

2-6.18 **deleted (AM#3)**

2-6.19 Electronic Industries Association Telecommunications Industry Association (EIA/TIA). EIA/TIA Standard EIA/TIA-570, is available from Electronic Industries Association, Engineering Department, Order From: Global Engineering Documents, 7730 Carondelet Ave., Suite 407 Clayton, MO 63105, Ph: 800-854-7179, or 714-979-8135, Fax: 314-726-6418

2-6.20 Illuminating Engineering Society of North America (IESNA). The IESNA Lighting Handbook, is available from Illuminating Engineering Society of North America, (IESNA), 120 Wall St., 17th Floor, New York, NY 10005-4001, Ph: 212-248-5000, Fax: 212-248-5017: http://www.iesna.org/

2-6.21 **International Conference of Building Officials (ICBO). The 2000 International Building Code and 2000 International Residential Code are available from the, INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO), 5360 S. Workman Mill Rd., Whittier, CA 90601-2298, Ph: 800-252-3602, Fax: 913-764-2272: http://www.icbo.org/ (AM#3)**

2-6.22 National Association of Architectural Metal Manufacturers Association (NAAMA). NAAMA Metal Finishes Manual, is available from the NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM), 11 So. LaSalle St., Suite 1400, Chicago, IL 60603, Ph: 312-201-0101, FAX: 312-201-0214:

2-6.23 National Association of Corrosion Engineers (NACE). NACE RP-0286, The Electrical Isolation of Cathodically Protected Pipelines, is available from NACE, P.O. Box 218340, Houston, TX 77218: http://www.nace.org/

2-6.24 **International Code Council (ICC). The International Plumbing Code, 5203 Leesburg Pike, Suite, 708, Falls Church, VA 22041-3401, 703-931-4533 [AM#0003].**

2-6.25 National Electrical Manufacturers Association (NEMA). NEMA standards listed below are available from the National Electrical Manufacturers Association (NEMA), NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA),2101 L St., NW, Suite 300,Washington, DC 20037-1526 Ph: 202-457-8474 Fax: 202-457-8473 NEMA DC 3, Wall-Mounted Room Thermostats; and NEMA WD 1, General Requirements for Wiring Devices: http://www.nema.org/

2-6.26 NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB), NEBB-01, Procedural Standards for Testing-Adjusting-Balancing of Environmental Systems, is available from NEBB, 875 Grove Mount circle, Gaithersburg, MD 20877-4121, Ph: 301-977-3698, Fax: 301-977-9589: http://www.nebb.org/

2-6.27 National Fenestration Rating Council (NFRC). NFRC 100-91, Procedure for Determining Fenestration Product Thermal Properties, is available from NFRC, 1300 Spring Street, Suite 500, Silver Spring, MD. Telephone: (301) 589-NFRC, http://www.nrfc.org

2-6.28 National Fire Protection Association, Inc. (NFPA). NFPA codes listed in Table 2-7 are available from the National Fire Protection Association, Inc. (NFPA), 1Battery March Park, P.O. Box 9101, Quincy, MA 02269. Telephone: (617) 770-3000, Fax: (617) 770-0700: http://www.nfpa.org/

TABLE 2-7 - NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) CODES

Code No.	Code Description
NFPA 13	Installation of Sprinkler Systems
NFPA 13R	Installation of Sprinkler Systems in Residential Occupancies Up To and Including Four Stories
NFPA 54	National Fuel Gas Code
NFPA 70	National Electrical Code (DoD Adopted)
NFPA 72	National Fire Alarm Code
NFPA 101	Life Safety Code
NFPA 101M	Alternative Approaches to Life Safety
NFPA 255	Method of Test of Surface Burning Characteristics of Building Materials
NFPA 501A	Manufactured Home Installations
NFPA 501D	Recreational Vehicle Parks and Campgrounds
NFPA 701	Standard Methods of Fire Tests for Flame Resistant Textiles and Films

2-6.29 National Sanitation Foundation, 3475 Plymouth Road, Ann Arbor, MI 48105. Telephone: (313) 769-8010, Fax: (313) 769-8010: http://www.nsf.org/.

2-6.30 National Wood Window and Door Association (NWWDA) standard, NWWDA I.S.2, Standard for Wood Window Units is available from the National Wood Window and Door Association (NWWDA), 1400 East Touhy Ave., Suite 470, Des Plaines, IL 60018, (847) 299-5200, Fax: (847) 299-1286: http://www.nwwda.org/.

2-6.31 Sheet Metal and Air Conditioning Contractors National Association (SMACNA). SMACNA Installation Standards for Residential Heating and Air Conditioning Systems and SMACNA-07, HVAC Systems, Testing, Adjusting, and Balancing, are available from SMACNA, 4201 Lafayette Center Drive, Chantilly, VA 22180, (703) 803-2980, Fax: (703) 803-3732: http://www.smacna.org/

2-6.32 Southern Building Code Congress International, Inc. The Standard Housing Code is available from Southern Building Code Congress International, Inc., 900 Montclair Road, Birmingham, AL 35213-1206. Telephone: (205) 5921-1853, Fax: (205) 591-9775: http://www.sbcci.org/.

2-6.33 Underwriters Laboratories, Inc. (UL) specifications listed in Table 2-8 are available from the Underwriters Laboratories, Inc. (UL), 333 Pfingston Road, Northbrook, IL 62096. Telephone: (847) 272-8800. Fax: (847) 509-6220: http://www.ui.com/.

TABLE 2-8 – UNDERWRITERS LABORATORIES SPECIFICATIONS

No.	Description (Specs. Are DoD Adopted)
UL 174	Water Heaters, Household Electric Storage Tank Type
UL 430	Waste Disposers
UL 507	Electric Fans
UL 555	Fire Dampers
UL 746C	Polymeric Materials - Use in Electrical Equipment Evaluations
UL 749	Household Dishwashers
UL 858	Household Electric Ranges
UL 923	Microwave Cooking Appliances
UL 900	Test Performance of Air Filter Units

3. SITE PLANNING AND DESIGN.

3-1 Scope. This project consists of **70** housing units with site amenities on **17.2 hectares (42.6 acres)** of land area. Of the 70 units, 20 will be designed for Sr. Non-Commissioned Officers (NCO) and 50 for Jr. NCOs. **Site amenities include, but are not limited to, the construction of new residential streets and the replacement of existing streets, as directed in the RFP, recreational features, sidewalks, utilities and drainage. (AM#4)** Imaginative site design is encouraged, however, the site boundaries, project composition, and gross density are fixed. Based on the graphic and narrative description of site opportunities and constraints provided, the offeror shall verify that the site meets the program requirements.

3-2 REFERENCES.

The design of this facility shall comply with the requirements of the applicable parts of the following references:

CESWD Architectural and Engineering Instruction Manual (CESWD-AEIM)

Uniform Federal Accessibility Standards, Federal Register (UFAS)

Americans with Disabilities Act Guidelines (ADA)

TM 5-803-5, Installation Design

TM 5-803-14, Site Planning and Design

TM 5-813-5, Water Supply, Water Distribution Systems

TM 5-814-1, Sanitary and Industrial Wastewater Collection- Gravity Sewers and Appurtenances

TM 5-814-2, Sanitary and Industrial Wastewater Collection- Pumping Stations and Force Mains

TM 5-820-4, Drainage for Areas Other Than Airfields

TM 5-822-2, General Provisions and Geometric Design for Roads, Streets, Walks, and Open Storage Areas

TM 5-822-5, Pavement Design for Roads, Streets, Walks, and Open Storage Areas

TM 5-822-7, Standard Practice for Concrete Pavements

TM 5-848-1, Gas Distribution

DG 1110-3-204, Design Guide for Army and Air Force Airfields, Pavements, Railroads, Storm Drainage, and Earthwork

MIL-HDBK-**1008C (AM#4)**, Fire Protection for Facilities

MIL-HDBK-1190, Facility Planning and Design Guide

HQUSACE Architectural and Engineering Instructions- Design Criteria (USACE AEI)

3-3 Area Development Plan. Provide a housing area development plan that shows the spatial and functional arrangement of all housing requirements. The plan should ensure an economical, compatible and functional residential land use development that utilizes the advantages of the site, fosters visual order, and provides a

sense of community. The area development plan shows consideration for the site opportunities and constraints, housing program requirements, and specific site design criteria and guidance provided. The recommendations of the Installation Real Property Master Plan and Installation Design Guide should be addressed.

3-3.1 Density. The project site is approved for LOW DENSITY siting. Land area for density calculations excludes slopes greater than 10 percent, major highways, flood plains and flood areas, lakes and water courses. Designated major recreation areas greater than 1.2 ha [3 acres] may be excluded from the density calculation.

3-3.2 Land use. The plan for the area should reflect an optimum balance of housing unit floor area, open space, play lots, recreational amenities and pedestrian and vehicular circulation. The plan should show an efficient, organized and economical land use arrangement that is compatible and functional. This plan should show the relationship of the area to adjacent land uses.

3-3.3 Noise. Use mitigation techniques to moderate predictable noise in accordance with the Installation Compatible Use Zone Program. All possible methods of mitigating the impact to the site and adjacent areas should be explored.

3-3.4 Buffer area. Provide appropriate buffer areas to separate and visually isolate the community from undesirable external influences and to separate adjacent officer and enlisted personnel housing areas from each other. The width of a street should be a minimum acceptable buffer zone between officer and enlisted personnel housing areas. Buffer areas may be used for recreational amenities, such as basketball courts, tot lots and trees. All possible methods of mitigating the impact to the site and adjacent areas should be explored. Buffer screening is desired along the southern and eastern boundaries of the site to separate the housing area from industrial and troop areas, respectively. Landscaping or berming is the desired method of screening.

3-3.5 Housing unit grouping. Variety in groupings, arrangements, and siting configurations of housing units is encouraged to fit varying terrain conditions and to provide compatible and functional residential layouts and street scapes. Building arrangements should be informal and imaginative with setbacks and orientation to provide for the best view, privacy, and variety. The proper grouping of housing units will provide backyard screening, separation of pedestrian and vehicular traffic, play lots and natural open spaces. The layout should reflect simplicity of design and provide a visual sense of community and should mirror the density and style reflected in the existing Patch-Chaffee housing area but does not limit the layout to a strictly linear configuration.

3-3.6 Housing unit variation. Housing unit variation shall afford distinctly different exterior appearances within each housing unit type. Provide stylistic compatibility that will give the neighborhood a sense of order. Housing units shall vary in two or more of the following: Floor plans, massing, elevation, carport location, and exterior materials. One floor plan for each housing unit type is acceptable if sufficient variety is achieved by means of other variations mentioned above. In addition, housing units shall vary in color and siting. A reverse floor plan (mirror-image), although an acceptable means of creating variety, shall not constitute a housing unit change. Offerors shall comply with land-use restraints set forth in this document. Five percent of the units shall be handicapped accessible and shall meet the requirements of the Uniform Federal Accessibility Standards (UFAS) and the Americans with Disabilities Act (ADA) and should be located at the northern portion of the site bound by Patch, Chaffee and W.W. White Roads (north of unit 881 and east of units 831 to 834). This would result in one (1) Sr. NCO unit and three (3) Jr. NCO units being handicapped accessible. The design should reflect life cycle maintenance and energy efficiency.

3-3.7 Housing unit orientation. Housing units shall be oriented, to the maximum extent possible within the constraints of the site available, so that a major section of the roof faces within 20 degrees of South. The purpose of proper orientation is to expose a minimum surface area to direct solar gain while allowing the units the potential for passive solar applications. Additional consideration will be given during the quality evaluations with respect to unit orientations and passive solar applications considered and included. For additional passive solar information and considerations, see paragraph 11- ENERGY CONSERVATION, of this Statement of

Work.

3-3.8 Grading. The grading should maintain existing topography while recognizing standard gradients for the housing units and various functions. If feasible, there should strive to be a balance of the quantity of cut and fill, which would create a smooth transition of graded areas into the existing natural site. The plan should reflect selective site clearing that preserves groups of trees, where applicable. Grading should manage site runoff. The principles of positive drainage should be applied to control the conditions that remove rainfall away from facilities and functions.

3-3.8.1 Turfed Areas. In any turfed area, the minimum slope shall be 2%. In housing unit backyards, the maximum slope shall be 3%. In other areas the finished grade should slope away from the buildings at 5% for at least 3 meters. In areas outside of housing unit yards, turfed slopes may vary between 2% minimum and a maximum of 25%, however the maximum slope should be avoided, if possible. Should slopes in excess of 25% be required, slope protection such as slope paving, should be employed or retaining walls shall be used to effect grade changes.

3-3.8.2 Roads, Streets, Access Drives and Parking Areas. Longitudinal grade changes in excess of 1% shall be accomplished by vertical curves. Profiles are mandatory for vertical control of centerline gradients.

3-3.8.3 Parking Areas. Pavement grades shall provide positive drainage with a 1% minimum slope in the direction of drainage. The maximum slope in the direction of parking shall be 1-1/2%. The slope perpendicular to the direction of parking shall be 5% maximum for bituminous or concrete surfaces and 3% for other surfaces.

3-3.8.4 Sidewalks. Sidewalks with a slope gradient equal to or less than 3% are preferred. Sidewalk transverse cross-slope shall be a 2% minimum with a maximum no greater than 5%. Any walkway with a slope greater than 4.2% shall be designated as a ramp. Sustained walkway grades greater than 3.3% shall have a level landing of at least 1.83m x 1.83m (6 ft x 6ft) at 18.3m (60 ft) intervals for rest and safety. Walks and ramps serving facilities that are accessible to and usable by the physically handicapped shall meet the requirements of UFAS and ADA.

3-4 Site Design Criteria. The following specific criteria, based on site density, are to be used as guidance in site design, and proposals will be **evaluated AM#4)** accordingly.

3-4.1 Housing units per hectare (ha) [acre (ac)] by site density are shown in Table 3-1 on the following page.

Pay Grade	Low Density	
	units/ha	units/ac
E-6 & Below	9.9-17.3	4-7
E-7 - E-9	7.4-12.4	3-5

3-4.4 Parking requirements by site density.

3-4.4.1 Low density: Two off-street stalls and one guest on-street stall per unit.

3-4.5 Children's outdoor play areas. Children's outdoor play areas are a requirement per number of housing units. See paragraph 3-7 for size and equipment specifications.

3-4.5.1 Play lot: One 325 m^2 [3,500 ft^2] play lot per 30 housing units. The play lot shall be designed to accommodate two age groups; 12 months to 5 years age group and 5 to 9 years age group. The play lot shall

have a capacity for approximately 15 to 35 children. These play lots should be located within site lines of the housing units and in close proximity to the Jr. NCO units.

(AM#5)

3-4.6 Site amenities Additional site amenities to be included in the design include picnic tables and grills at the play lots, half-court basketball courts and walks. New walks shall be located only on one side of the street and shall be designed to connect the new housing area to both new and existing amenities. The amenities should be sited so as to provide easy access to the units that will be located at the site boundaries.

3-5 Building Setbacks and Spacing. Clearances between and adjacent to buildings must consider requirements for fire protection, safety, privacy, and emergency access in addition to the following minimum criteria. Setback or yard dimensions shall be from the building wall to an imaginary lot line around each building measured perpendicular to the building. Wall lengths with horizontal offsets of 1.8 m [6 ft] or more may be measured separately when determining yard depth. Distance between buildings shall be not less than the sum of setbacks or yards, as required.

3-5.1 Minimum setbacks and spacing for low density sites is shown in Table 3-4.

TABLE 3-4 - MINIMUM SETBACKS AND SPACING, LOW DENSITY SITES

Description	Meters	[Feet]
From front of house to curb of residential street.	7.5	25
From house to major/arterial highway. (Edge of pavement)	45.0	150
From house to collector street. (Edge of pavement)	30.0	100
Side of carport **(AM#4)** to curb.	6.0	20
Side of house to curb[1].	6.0	20
Between sides of carports **(AM#4)** and houses[1].	1.5	5
Between outside walls of houses[1].	6.0	20
Between rear walls of houses.	24.0	80
Between side and rear walls of houses.	12.0	40
Between street face of carport **(AM#4)** and curb or sidewalk when second off- street parking space is next to **(AM#4)** carport.	2.4	8
Between street face of carport **(AM#4)** and curb or sidewalk when second off-street parking space is between carport **(AM#4)** and street.	8.5	28

Note[1]: When patios are located within a yard, separation shall not be less than 12.0 m [40 ft].

3-5.3 Setback Notes.

3-5.3.1 Where the slope is 3:1 or steeper, top and toe of slope shall be a minimum of 4.5 m [15 ft] from the building.

3-5.3.2 Courts, outer and inner, shall have dimensions not less than the sum of the required yard distances. An inner court shall have a minimum area of 9.29 m² [100 ft²] for a one-story building.

3-6 **Circulation and Parking (AM#4)**. The vehicular and pedestrian circulation system shall promote safe, efficient movement of vehicles and pedestrians within the housing area. It should maintain the maximum separation of vehicles and pedestrians. Safe circulation systems have a clear hierarchy of movement, lead to a clear destination, and do not interrupt other functions. The following criteria shall be considered for designing streets and drives for vehicles and pedestrians:

3-6.1 Vehicular circulation. Vehicular circulation layout is determined by applying the design vehicle templates to the site design. The passenger car class includes passenger cars and light delivery trucks, such as vans and pick-ups. The passenger car template is equivalent to the non-organizational - privately owned vehicle (POV). The truck class template includes single-unit trucks, recreation vehicles, buses, truck tractor-semitrailer combinations, and trucks or truck tractors with semi-trailers in combination with full trailers. Templates showing the turning movements for design vehicles are provided by the American Association of State Highway and Transportation Officials (AASHTO). Design site entrances, exits, service drives, and special circulation areas to accommodate the largest vehicle that uses the area. In the case of family housing the largest vehicle to use the area on a weekly basis would be the 12 m (40 ft) garbage truck. Provide the vehicle clearances that are required to meet traffic safety for emergency vehicles, service vehicles, and moving vans. Streets shall include required traffic control and street identification signage, maximum spacing between drives, right-angle turns, and limit points of conflicts between traffic.

3-6.1.1 Definitions.

3-6.1.1.1 Nonresidential Streets

3-6.1.1.1.1 Arterial. Major roads and street systems external to the residential area.

3-6.1.1.1.2 Collector. Feeder street connecting external street system with residential streets in the subdivision and adjoining areas subject to future development. No houses shall be located on collector streets, and no driveway or access shall be from collector streets

3-6.1.1.2 Residential Streets

3-6.1.1.2.1 Loop. Both ends open to traffic.

3-6.1.1.2.2 Cul-De-Sac. Only one end open to access street and a turnaround (T, Y, or Circle) at the other end.

3-6.1.2 Cul-De-Sac Design. The circulation system may be based on cul-de-sacs a maximum 182.8 m [600 ft] long, measured from the center of the cul-de-sac to the centerline of the access street.

3-6.1.3 Intersection Design. Provide "T" intersection offsets of at least 38.1 m [125 ft]. The preferred angle of intersection is right-angle (90 degrees).

3-6.1.4 Street design. Street dimensions are determined by the selected design vehicle templates. Separation, corner clearances, and sight distance are established when the design vehicle templates and speed limits are selected. Streets shall be designed for vehicles with not less than 2721.5 kg [6,000 lb] code wheel load. Pavement shall be asphaltic concrete as described in the furnished **Attachment 7A-GEOTECHNICAL REPORT (AM#5)**. The Installation desires that Road No. S-23 is utilized for the whole run

of the community. **Replace Road No. S-23 between Lawton and Crockett Roads. Replace the street located one block east of Road No. S-23, between Harney and Schofield Roads. This street may be rerouted, as deemed necessary. (AM#4).** Streets shall be provided with standard barrier type reinforced concrete curbs and gutters. Reinforcement shall be #10M bars. Turning **radii** on streets and service roads shall be designed to accommodate a fire department ladder truck. Curbs shall be depressed at entrances to driveways. All gradients shall provide positive drainage with no ponding. Longitudinal street grades shall vary between 0.3% minimum and 6% maximum. Vertical curves shall be provided where longitudinal grade changes equal 1% or more.

3-6.1.5 Housing unit access drive. Access drives should provide traffic safety distances which allow safe entry and exit. Access drives serving more than 8 housing units, or subject to service and emergency truck traffic shall be designed as a street.

3-6.2 Privately owned vehicle (POV) parking. POV stalls without vehicle overhang shall be a maximum 2.7 m x 5.5 m [9 ft x 18 ft]. The design vehicle template that is used to design this space shall be described. Design on-street parking stalls to be of sufficient length and width to allow safe movement into and out of the stall and to adequately separate the parked vehicle from the traffic flow. On-street parking will not be allowed on service roads. Signage should provided which reflects this requirement. Provide compact passenger car dimensions only when recommended by a Site Traffic Impact Study.

3-6.2.1 Housing unit POV parking. POV parking areas consisting of more than 4 vehicles backing into the street are unacceptable.

3-6.2.2 Off-street parking lots. A 90-degree parking layout is preferable. Maintain two-way movement and avoid dead-end parking lots. Provide more than one entrance and exit drive. In large parking lots provide a minimum 10 percent of the total paved area for landscape plant material.

3-6.3 Deleted (AM#4)

3-6.4 Pedestrian circulation. Pedestrian circulation should be safe, separated from vehicle circulation, and relate to the housing units, parking, and community facilities. Pedestrian circulation should be based on pedestrian desired lines of walking between facilities. Desired lines should be weighted to predict the most traveled routes. These routes would require paving. Topography and vegetation can be used to reinforce a sense of movement. Design pedestrian concentration areas with adequate paved area.

3-6.4.1 Sidewalk design. Sidewalks shall be provided on one side of the street. Walks shall be a minimum of 1.22 m [4 ft] wide (except for those in the vicinity of the handicapped accessible units and accessible site amenities) exclusive of curb width, and made of nonreinforced concrete with a minimum thickness of 100 mm [4 in]. Walks in the vicinity of the handicapped accessible units and accessible site amenities shall be designed as specified in UFAS and ADA. Where walks are adjacent to the curb, the curb width is not to be included as sidewalk. Ramps for handicapped individuals shall be provided at intersections by depressing street curbs and adjacent sidewalk and shall meet the requirements specified in UFAS and ADA. Concrete construction shall also apply to porches, patios, stoops and walks unit entrances.

3-6.5 Signs. Locate all proposed signs on a site plan in accordance with distance and placement guidelines. The signing system should provide consistency and continuity to the overall visual image of the installation. The signs shall be coordinated with the design of other site furnishings to minimize the number of streetscape elements and reduce clutter.

3-6.5.1 Traffic signs. Traffic signs shall be in accordance with the latest edition of the Manual on Uniform Traffic Control Devices for Streets and Highways, U.S. Department of Transportation, Federal Highways Administration.

3-7 Children's Outdoor Play Areas. The design of the children's outdoor play areas shall comply with the safety requirements of ASTM F 1487 and ASTM F 1292. The children's outdoor play areas are unsupervised

play areas and do not have a supervised play program for child development. These areas are not part of trained recreation, youth center or child development staff support. Supervised outdoor play areas occur at youth centers and child development centers.

3-7.1 Child Safety and Accessibility.

3-7.1.1 Accessibility to children and adults with disabilities. Play areas shall be accessible to children and adults with disabilities. In addition to wheelchair users, the needs of children and adults who walk with canes, walkers, or crutches; who have limited use of the upper body; who have visual or hearing disabilities, or who have developmental disabilities shall be considered. Design criteria based on child dimensions should be used for the proper functioning of the play area. Every part of a play area may not be accessible to all its users, but the social experience provided should be accessible to everyone. When more than one play activity of the same type is provided, one shall be accessible. When one activity is provided, it shall be accessible. A diverse play area has the greatest potential for meeting the needs of all users. Separate play areas for the physically challenged are not acceptable. Integrating all children in the same play setting will be emphasized. Guidelines available from this design district for accessible routes, ramps for wheelchair access, transfer points, wheelchair accessible platforms, and accessible stepped platforms should be followed.

3-7.1.2 Age appropriate scale. Age appropriate scale is a term used to describe equipment which will allow safe and successful use by children of a specific chronological age, mental age, and physical ability. Play equipment height and complexity will not exceed the user's ability. The children's outdoor play areas will meet age appropriate scale for the age groups that the areas are designed to accommodate.

3-7.1.3 Use zones. In accordance with ASTM F 1487, a use zone is a clear, unobstructed area under and around play equipment where a child would be expected to land when jumping or falling from a piece of play equipment. These zones require a playground safety surface in accordance with ASTM F 1292. Requirements for use zones vary for the age group and for different pieces of equipment. All use zones for play equipment should be shown on the site plan to ensure there is no conflict between play activities on the ground and swinging or jumping from the equipment. Use zones will not overlap except for spring rocking equipment, balance beams, and play houses.

3-7.1.4 Playground safety surface. A playground safety surface is constructed of a material that meets the shock absorbency criteria recommended in ASTM F 1292. Playground safety surfaces shall be provided throughout all use zones and under all play equipment as required.

3-7.1.5 Inappropriate play events. The following play events are not appropriate for use in unsupervised play areas: Chain walks, chain or tire climbers, fulcrum seesaws, log roles, May poles, merry-go-rounds, rotating equipment, spring rocking equipment intended for standing, swinging exercise bars, trapeze bars, and whirls.

3-7.2 Play lot. Provide play lots that are located within the site lines of the housing units to be supported. Connect play lots to the units by a walkway system that meets the requirements as specified for sidewalks above. Provide shade. Each play lot shall be provided with the following age appropriate play events and equipment for the two age groups to be accommodated:

3-7.2.1 Pathway. The pathway should encompass the perimeter of the area, accommodate wheeled toys, and consist of different textures, colors, and patterns for games.

3-7.2.2 Gathering place. This setting provides an open space for groups of different sizes and people of all ages. Provide an infant crawl area. The seating materials may include boulders, timbers or logs arranged with vegetation to create a room like atmosphere. A shelter may be provided.

3-7.2.3 Sand play setting. This setting supports creative play and social interaction. It provides children with a manipulative play environment. The play elements include sand, water, sand tables, containment barriers and boulders. The sieve size for sand should consist of a fine washed plaster sand. The sand used here is not the same sieve size as the sand used for the use zones. This setting should be located adjacent to the play

village.

3-7.2.4 Play village. This setting supports a playhouse and a water source. It should be located adjacent to the sand play setting.

3-7.2.5 Dramatic play setting. This setting supports dramatic play elements such as playhouses, play platforms, and an open area for seating on the ground.

3-7.2.6 Manufactured play equipment setting. This setting includes an age appropriate composite structure consisting of multiple play events for each of the following age groups; 12 months to 2 years of age, 2 to 5 years of age and 5 to 9 years of age. Other play events include freestanding equipment such as spring rocking equipment, swing, and balance beam. The swing should be located as a freestanding play event on the perimeter.

3-7.3 Sports and games areas. Provide half-court basketball courts. Other design elements include asphalt surfacing, fences, drinking fountains, lighting, seating and trash receptacles.

3-7.4 Plant materials. Plants and ground cover should be integrated into play settings. Plants provide a variety of learning opportunities, as they become a source for play material for crafts, dramatic play, and sensory experience. Plants define space and provide shade. Poisonous plants and plants with thorns are not allowed and should be removed from the play areas.

3-8 Landscape Planting Plan. The offeror shall obtain and use the services of a qualified landscape architect, experienced in site planning and planting design. A complete, integrated landscape planting plan incorporating the Fort Sam Houston Landscape Master Plan shall be provided for the overall housing project. The design shall reflect appropriate groupings, and street tree plantings to define the open spaces to ensure a complete landscaped project. Undesirable views shall be screened from the housing units and play areas. **Housing will have screening along the southern and eastern boundaries of the site to screen the housing areas from industrial and troop areas, respectively (AM#5).** The screening may be accomplished through the use of landscaping, berms or a combination of the two. The screening shall be at least 50% effective when installed and should be designed offer a minimum of 85% coverage after 3 growing seasons. Screening with fencing is not desirable. It is important that the Western border of the site be screened form the adjoining work areas. Foundation plantings for each house will not be required although a series of typical planting plans may be provided to guide the new residences in installing the foundation plantings themselves. Choose plant materials on the basis of plant hardiness, climate, soil conditions, low maintenance, and quality. Selected plant materials shall be easily maintained and tolerant of the specific site conditions. Planting or seeding shall occur only during periods when beneficial results can be obtained.

3-8.1 Trees, shrubs, and ground cover. Plant varieties shall be nursery grown or plantation grown stock conforming to ANSI/ANLA Z60.1. The varieties chosen shall be chosen from the approved list accompanying the existing master plan. They shall be grown under climatic conditions similar to those in the locality of the project.

3-8.1.1 Quality. Well-shaped, well-grown, vigorous, healthy plants having healthy and well-branched root systems shall be provided. Plants shall be free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement, and abrasion. Plants shall be provided that are typical of the species or variety, and conforming to standards as set forth in ANSI/ANLA Z60.1.

3-8.1.2 Shade and flowering trees. A height relationship to caliper shall be provided as recommended by ANSI/ANLA Z60.1. Height of branching should bear a relationship to the size and variety of tree specified, and with the crown in good balance with the trunk. Trees shall not be "poled" or the leader removed.

3-8.1.2.1 Single stem. Trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.

3-8.1.2.2 Multi-stem. All countable stems, in aggregate, shall average the size specified. To be considered a stem, there should be no division of the trunk which branches more than 150 mm [6 in] from the ground level.

3-8.1.2.3 Specimen. A plant shall be provided that is well branched and pruned naturally according to the species. The form of growth desired, which may not be in accordance with natural growth habit, shall be as indicated.

3-8.1.3 Deciduous shrub. Plants shall be provided that have the height and number of primary stems as recommended by ANSI/ANLA Z60.1. An acceptable plant shall be well shaped with sufficient well-spaced side branches recognized by the trade as typical for the variety grown in the region.

3-8.1.4 Coniferous evergreen. Trees shall be provided that have the height-to-spread ratio as recommended by ANSI/ANLA Z60.1. Trees shall not be "poled" or the leader removed. An acceptable plant shall be exceptionally heavy, well shaped and trimmed to form a symmetrical and tightly knit plant. The form of growth desired shall be as indicated.

3-8.1.5 Broadleaf evergreen. Plants shall be provided that have ration of height-to-spread as recommended by ANSI/ANLA Z60.1. An acceptable plant shall be well shaped and recognized by the trade as typical for the variety grown in the region.

3-8.1.6 Ground cover. Plants shall be provided with the minimum number of runners and length of runner as recommended by ANSI/ANLA Z60.1. Plants shall be furnished that have heavy, well developed, and balanced top with vigorous well developed root system, and shall be furnished in containers.

3-8.1.7 Measurement. Plant measurements shall be in accordance with ANSI/ANLA Z60.1.

3-8.1.8 Percolation test. Test for percolation shall be done to determine positive drainage of plant pits and beds. All soil and drainage conditions detrimental to the growth of plant material shall be identified and a proposal correcting the conditions shall be submitted.

3-8.2 Soil test. A soil test shall be performed for pH, chemical analysis, and mechanical analysis to establish the quantities and type of soil amendments required to meet local growing conditions for the type and variety of plant material specified.

3-8.3 Installation. Verify the location of underground utilities. When obstructions below ground or poor drainage affect the planting operation, proposed adjustments to plant location, type of plant, and planting method or drainage correction shall be submitted. The plant material shall be installed during appropriate planting times and conditions recommended by the trade for the type and variety of plant material specified. Plant pits shall be excavated and backfilled as recommended by the trade and ANSI/ANLA Z60.1. The planting operation shall be performed only during periods when beneficial results can be obtained. When special conditions warrant a variance to the planting operations, proposed planting times shall be submitted.

3-8.4 Pruning. The total amount of foliage shall be pruned by one-fourth to one-third on installed trees and shrubs to compensate for loss of roots and transplanting shock. The typical growth habit of individual plants shall be retained. Trees shall not be poled or the leader removed, nor shall the leader be pruned or "topped off".

3-8.5 Maintenance during planting operation. Installed plants shall be maintained in a healthy growing condition. Maintenance operations shall begin immediately after each plant is installed and shall continue until the plant establishment period commences.

3-8.6 Plant establishment period. On completion of the last day of the planting operation, the plant establishment period for maintaining installed plants in a healthy growing condition shall commence and shall be in effect for the remaining contract time period not to exceed 12 months. When the planting operation extends over more than one season or there is a variance to the planting times, the plant establishment

periods shall be established for the work completed.

3-8.7 Maintenance during establishment period. The maintenance of plants shall include straightening plants, tightening stakes and guying material, repairing tree wrap, protecting plant areas from erosion, maintaining erosion material, supplementing mulch, accomplishing wound dressing, removing dead or broken tip growth by pruning, maintaining edging of beds, checking for girdling of plants and maintaining plant labels, watering, weeding, removing and replacing unhealthy plants.

3-8.8 Unhealthy plant. A plant shall be considered unhealthy or dead when the main leader has died back, or 25 percent of the crown is dead. Determine the cause for an unhealthy plant. Unhealthy or dead plants shall be removed immediately and shall be replaced as soon as seasonal conditions permit in accordance with the following warranty paragraph.

3-8.9 Warranty. Furnished plant material shall be guaranteed to be in a vigorous growing condition for a period of 12 months regardless of the contract time period. A plant shall be replaced one time under this guarantee. Transplanting existing plants requires no guarantee.

3-8.10 Turf. Turf consists of seed, sod, and sprigs. There may be several different types of turf mixtures applied; one for lawn areas around housing units and one for field or recreation areas. The boundaries of each area shall be clearly defined on the planting plan.

3-8.10.1 Seed quality. State approved seed of the latest season's crop shall be provided in the original sealed packages bearing the producer's guaranteed analysis for percentages of mixture, purity, germination, hard seed, weed seed content, and inert material. Labels shall be in conformance with applicable State seed laws. Seed mixtures shall be proportioned by weight. Weed seed shall not exceed one percent by weight of the total mixture.

3-8.10.2 Sod. State approved sod shall be provided as classified by applicable State laws. Each individual sod section shall be of a size to permit rolling and lifting without breaking.

3-8.10.2.1 Quality. The sod shall be relatively free of thatch, diseases, nematodes, soil-borne insects, weeds or undesirable plants, stones larger than 50 mm [2 in] in any dimension, woody plant roots, and other material detrimental to a healthy stand of turf. Sod that has become dry, moldy, or yellow from heating, or has irregular shaped pieces of sod and torn or uneven ends shall be rejected.

3-8.10.2.2 Thickness. Sod shall be machine cut to a uniform thickness of 306 mm [1ft 1/4 in] within a tolerance of 6 mm [1/4 inch] excluding top growth and thatch. Measurement for thickness shall exclude top growth and thatch.

3-8.10.2.3 Time limitation. The limitation of time between harvesting and placing sod shall be 36 hours.

3-8.10.3 Sprig quality. The cultivar shall be provided as healthy living stems, stolons, or rhizomes with attached roots, including two or three nodes, and shall be from 100 mm to 150 mm [4 in to 6 in] long, without adhering soil. Sprigs shall be provided which have been grown under climatic conditions similar to those in the locality of the project. Sprigs shall be obtained from heavy and dense sod, free from weeds or other material detrimental to a healthy stand of turf. Sprigs that have been exposed to heat or excessive drying shall be rejected. The time limitation between harvesting and placing sprigs shall be 24 hours.

3-8.10.3.1 Soil test. A soil test shall be performed for pH, chemical analysis, and mechanical analysis to establish the quantities and type of soil amendments required to meet local growing conditions for the type and variety of turf specified.

3-8.11 Temporary turf cover. When there are contract delays in the turfing operation or a quick cover is required to prevent erosion, the areas designated for turf shall be seeded with a temporary seed. When no other turfing materials have been applied, the quantity of one-half of the required soil amendments shall be

applied and the area tilled.

3-8.12 Installation. The turf shall be installed during appropriate planting times and conditions recommended by the trade for the type and variety of turf specified. The turf operations shall be performed only during periods when beneficial results can be obtained. Drainage patterns shall be maintained. The turf shall be installed by using the methods as recommended by the trade for the type and variety of turf specified.

3-8.13 Protection. Immediately after turfing, the area shall be protected against traffic or other use by erecting barricades and providing signage as required.

3-8.14 Turf establishment period. The turf establishment period for establishing a healthy stand of turf shall begin on the first day of work under the turfing contract and shall end three months after the last day of the turfing operation. An unsatisfactory stand of turf shall be repaired as soon as turfing conditions permit.

3-8.15 Satisfactory stand of turf.

3-8.15.1 Seeded lawn area. A satisfactory stand of turf from the seeding operation for a lawn area is defined as a minimum of 160 grass plants per square meter. Bare spots shall be no larger than 150 mm [6 in] square. The total bare spots shall not exceed two (2) percent of the total seeded area.

3-8.15.2 Seeded field area. A satisfactory stand of turf from the seeding operation for a field area is defined as a minimum of 100 grass plants per square meter. The total bare spots shall not exceed two (2) percent of the total seeded area.

3-8.15.3 Sodded area. A satisfactory stand of turf from the sodding operation is defined as living sod uniform in color and texture. Bare spots shall be no larger than 50 mm [2 in] square.

3-8.15.4 Sprigged area. A satisfactory stand of turf from the sprigging operation is defined as a minimum of 20 sprigs per square meter. Bare spots shall be no larger than 225 mm [9 in] square. The total bare spots shall not exceed two (2) percent of the total sprigged area.

3-8.16 Maintenance during establishment period. The maintenance of the turfed areas shall include eradicating weeds, eradicating insects and diseases, protecting embankments and ditches from erosion, maintaining erosion control materials and mulch, protecting turf areas from traffic, mowing, watering, post-fertilization, and replacing unsatisfactory turf areas.

3-9 DELETED

4. SITE ENGINEERING.

4-1 Soils.

4-1.1 Soil, Foundation and Pavement Report (Geotechnical Report). A preliminary Soil, Foundation and Pavement Report is provided as part of this RFP. A drawing indicating Subsurface Explorations and Geologic Profiles for the proposed site is also provided. The report provides an overview of soils and geologic conditions, and is furnished for informational purposes only. The offeror to whom this contract is awarded shall, with his or her consulting professional geotechnical engineer experienced in geotechnical engineering, be responsible for determining site specific geotechnical conditions.

4-1.1.1 The Contractor provided site specific geotechnical conditions report shall include, but not be limited to:

4-1.1.1.1 Classification of soil and rock.

4-1.1.1.2 Depth to bedrock.

4-1.1.1.3 Extent of boulders.

4-1.1.1.4 Bearing capacity of soil and rock.

4-1.1.1.5 Settlement potential.

4-1.1.1.6 Compaction requirements.

4-1.1.1.7 Groundwater characteristics.

4-1.1.1.8 Infiltration and permeability.

4-1.1.1.9 Erosion and siltation.

4-1.1.1.10 Surface and subsurface drainage.

4-1.1.1.11 Soil resistivity.

4-1.1.1.12 DELETED

4-1.1.2 The offeror and his or her professional geotechnical engineer consultant shall certify in writing that the design of the project has been developed consistent with the site specific geotechnical conditions. The certification shall be stamped by the consulting professional geotechnical engineer and shall be submitted with the **60 (AM#4)** percent design submission. If revisions are made to the **60 (AM#4)** percent design submission, a new certification shall be provided with the final design submission.

4-1.2 Soil compaction.

4-1.2.1 Soil compaction shall be achieved by equipment approved by a professional geotechnical engineer. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the compaction specified with the equipment used. Compact each layer to not less than the percentage of maximum density specified in Table 4-1, determined in accordance with ASTM D 1557 Method D.

TABLE 4-1 – SOIL COMPACTION

Subgrade Preparation, Fills, Embankments, and Backfills	Minimum Compaction Requirements (Percentage of Maximum Density)
Structures & Building Slabs	90
Streets, Paved Areas, Bike Paths	90
Sidewalks	85
Grassed Areas	80

4-1.2.2 The requirements shall be verified or modifications recommended by the consulting professional geotechnical engineer in the report wherever engineering, soils, or climatic factors indicate the necessity. Any modification to the stated compaction requirements shall require the approval of the Contracting Officer.

4-1.3 Capillary water barrier. A capillary water barrier is required for all interior slabs on grade, including **(AM#4)**, carports and storage rooms. As a minimum, the capillary water barrier shall be 6 inches.

4-1.4 Soil treatment. Soil treatment for termites shall be by the chemical method. Methods, and extent of protection required, shall comply with local or state industrial standards, whichever is the more stringent.

4-1.5 DELETED

4-1.6 Radon mitigation. The Contractor shall refer to paragraph 14- ENVIRONMENTAL for radon issues.

4-2 Water Distribution System. Connection to the existing water distribution system shall be made at the nearest water main capable of meeting the requirements for service to the facilities.

4-2.1 Water Mains and Building Service Connections. Mains shall be considered as that part of the distribution system supplying fire hydrants, or fire hydrant laterals. Service connections supply water from the main to the building. Separate meters will be provided at each unit. Mains shall be looped with no dead ends and be of adequate size to satisfy both domestic and fire flow requirements. Minimum main size is 0.15 m [6 in]. Sufficient sectional control valves shall be provided so that no more than two fire hydrants will be out of service in the event of a single break in a water main. A copper tracer wire shall be placed directly above all non-metallic mains when plastic marking tape does not provide means of determining alignment of pipe by metal detecting equipment. The pipe, valves, and all other materials shall meet the American Water Works Association (AWWA) standards for a 1,034.2 kPa [150 psi] working pressure system. Provide sacrificial anodes for all valves and metal pipe. Building connections shall be designed and constructed in accordance with the National Standard Plumbing Code.

4-2.2 Flow requirements. Water must be supplied by mains of appropriate capacity to provide 37.9 L/s [500 gpm] **at one-story units and 56.8 L/s [750 gpm] at two-story structures, (AM#3)** for a flow duration of 1-1/2 hours. This mandatory flow is over and above domestic requirements. Domestic requirements shall be based on 1135.6 liters/day (300 gal/day) per housing unit for single family housing **and duplexes. AM#3)** Mains shall be sized to carry this flow with a 2.5 peak hourly factor. Pressure shall be a minimum of 137.9 kPa [20 psi] at the required flows indicated above for each fire hydrant, and a maximum of 1,034.2 kPa [150 psi] at each outlet after allowing for friction, elevation, and other pressure losses. Pressure at each housing unit shall not exceed 517.1 kPa [75 psi]. Fire flow data is included as ATTACHMENT 9.

4-2.3 Trenches. Water and gas mains may be installed in the same trench, with the gas main placed on a shelf at least 0.3 m [12 in] above and to one side of the water mains. (Coordinate with the local gas utility supplier to determine system acceptability). Water mains shall have a minimum of 0.9 m [3 ft] of earth cover.

Minimum cover above water lines shall be 0.75 m [2 ft 6 in] in grassed areas and 0.9 m [3 ft] in paved areas. Adequate cover must be provided for freeze protection. Where frost penetrates to a depth greater than the minimum above, greater cover will be required. Sufficient cover must also be provided to protect the pipe against structural damage due to superimposed surface loads. Lines laid lower than the minimums stated shall be concrete encased with a minimum concrete thickness of 0.15 m [6 in].

4-2.4 Fire hydrants. Hydrants shall conform to AWWA C502, Dry-Barrel Fire Hydrants. Valves shall conform to AWWA C500, Gate Valves for Water and Sewerage Systems. Fire hydrants shall be compatible with those presently in use at the installation or local Government Juridicant, with similar pump and hose connections for one 115 mm (4-1/2") pumper connection and two 65 mm (2-1/2") hose connections. Fire hydrant spacing shall be no greater that 152 m [500 ft] apart, by paved road. In addition, a hydrant shall be provided so that all parts of the housing units can be reached by hose lines not over 107 m [350 ft] long. Hydrant laterals shall be 0.15 m [6 in] minimum size, shall not exceed 15.2 m [50 ft] in length, and shall have an underground shutoff valve. Valve box, at each lateral, shall be located within 3 m [10 ft] of the hydrant, and shall not be located where obstructed by parked vehicles, shrubbery, etc. Guard post barriers shall be provided where hydrant locations are subject to vehicle damage. A minimum 1.5 m (5 ft) clearance shall be maintained between fire hydrants and poles, trees, shrubs or other permanent obstructions. Hydrants shall be located no closer than 1 m (3 ft) and no further than 2 m (7 ft) from the street curb line. Fire flow data, for hydrants in the existing Patch-Chaffee area, is included as ATTACHMENT 9.

4-2.5 Shutoff valve. Each building shall be provided with a separate service and main shutoff valve, readily accessible to maintenance and emergency personnel. Shutoff valves in walks are prohibited.

4-2.6 Valve Boxes. Valve boxes shall be cast iron of approved manufacture. Boxes shall be extension type with slide type adjustment and with flared base. The word "WATER" shall be cast in the cover. The boxes shall be of such length as will be adapted, without full extension, to the depth of cover required over the pipe at the valve location. Valve boxes shall be suitable for traffic. Cast iron valve boxes shall be bonded with the ferrous valve and cathodically protected. Cast iron valve boxes shall have a protective coating applied using a coal tar epoxy.

4-2.7 Materials for Water Lines. Acceptable materials for water lines are as follows:

4-2.7.1 Service Lines less than 80 mm (3")in diameter: galvanized steel, polyvinyl chloride (PVC) plastic, Oriented PVC plastic polyethylene or copper tubing.

4-2.7.2 Service Lines greater than or equal to 80 mm (3") in diameter: ductile iron, PVC, filament-wound or centrifugally cast reinforced thermosetting resin, reinforced plastic mortar pressure pipe or steel.

4-2.7.3 Distribution Lines greater than or equal to 80 mm (3") in diameter: ductile iron, PVC through 900 mm (36") nominal diameter plastic, Oriented PVC plastic filament-wound or centrifugally cast reinforced thermosetting resin, reinforced plastic mortar pressure pipe or reinforced concrete.

4-3 Sanitary Sewerage System. Connection to the existing sewage collection system shall be made at the closest sewer line(s) capable of servicing the housing units. Sewage collection systems shall be designed and constructed in accordance with the National Standard Plumbing Code criteria in this paragraph, and installation requirements. Pipe sizes and slopes shall be calculated using the Manning Formula. Manholes are required at all changes of direction and spaced not more than 152 m [500 ft] apart. A fixed siderail ladder shall be provided for manholes greater than 3.6 m (12 ft) in depth. The word "SEWER" shall be cast in manhole covers. Curved sewers are prohibited. Pipes shall be designed to flow full and maintain a minimum velocity of 0.6 m [2 ft] per second. If siphons are used, two lines of equivalent capacity shall be used with cleanouts. Where pumping is required, force mains shall be sized to minimize pumping head, with a 0.9 m to 1.5 m [3 ft to 5 ft] per second velocity.

4-3.1 Sewer mains. Design shall be based on an average daily per capita flow of sanitary sewage of 378.5 L [100 GAL] per day with a 4.0 peak hourly factor. Mains shall be a minimum of 0.2 m [8 in] in diameter.

4-3.2 Sewer Building Laterals. Each building lateral shall be connected directly to a sewer main. Manholes shall be provided where lateral lines exceed 30 m (100 ft) in length from the housing unit to the service main line.
Combining multiple building laterals is prohibited. Two-way cleanouts shall be provided to allow cleaning of all lines to grade. Cleanouts, in yard areas, shall be set in a box with a hinged cover. Laterals from one building shall not cross under another building. Lines shall be sized in accordance with the National Standard Plumbing Code. Sewer laterals serving a housing unit shall be a minimum of 0.15 m [6 in] in diameter.

4-3.3 Trenches. Sewer and water lines, mains or laterals, shall be placed in separate trenches. The separate trenches shall maintain a minimum lateral separation of 3.0 m [10 ft].

4-3.4 Cover. Sewer lines shall be located at a depth greater than the frost penetration. Minimum cover above the top of pipes shall be 0.6 m [2 ft] in areas not subject to vehicular loads and 0.9 m [3 ft] in all other areas. If the minimum cover can not be met, the length of pipe shall be concrete encased with a minimum 0.07 m [3 in] thickness of concrete.

4-3.5 Acceptable Materials for Sanitary Sewer Lines. Non-reinforced Concrete (bell and spigot), Plastic (PVC or ABS), reinforced plastic mortar pipe, reinforced thermosetting resin pipe, ductile iron, cast iron soil pipe or clay (extra strength). Cement used for concrete pipe fittings, manholes and other sanitary sewer structures shall be Type V.

4-3.6 Design Criteria. Gravity lines shall be sized based upon peak flow and designed to provide a minimum velocity of 2 feet per second (fps) at the average daily flow rate and a minimum velocity of 2.5 fps to 3.5 fps at 1/2 the peak flow rate. The maximum flow velocity shall not exceed 10 fps, based on peak flow. For gravity lines, Manning's formula shall be used. Manning's "n" values less than 0.013 shall not be permitted despite manufacturer's reports of "n" values between 0.009 and 0.011. When the required 2 fps flow velocity at the average flow rate cannot be met in gravity sewer lines (lateral or main) due to inadequate flow, a minimum slope of 0.6% shall be provided for 150 mm (6") lines and 0.4% for 200 mm (8") lines.

4-4 Storm Drainage System. The storm drainage system shall be properly coordinated with surrounding properties to ensure that runoff does not cause damage to other properties. All drainage lines, if required, shall remain in conduit to stable grade. The minimum pipe size shall be 300 mm (12") inside diameter. The minimum velocity of flow in conduits during a design storm shall be 0.07 m/s [2 ft 6 in/s]. Storm water collection, disposal (and retardation) system shall be designed for a minimum of a 10-year return frequency. Rainfall intensities for project locations shall be in accordance with local community/locality/State Transportation (Highway) agency design parameters.

4-4.1.1 Storm Runoff. The Rational Method as described in **ATTACHMENT 6 (AM#4)** shall be used to calculate storm runoff. Stormwater detention shall be incorporated which minimizes erosion and settling. Detention should be designed to avoid creating an area that is unsightly, difficult to maintain or a menace to health or safety.

4-4.1.2 Storm Drainage Design. Runoff from other properties presently directed towards the new project site shall be incorporated into the new storm drainage system design to ensure that this runoff does not cause damage to surrounding properties and the new housing area. Storm drains shall be designed in accordance with criteria in **ATTACHMENT 6 (AM#4)**. Storm drain systems shall be designed so that the hydraulic grade line for the computed design discharge is as near optimum depth as practicable, and velocities are not less than 2.5 fps when the drains are one-third or more full. Energy dissipators shall be provided at storm drain outlets where outlet velocities exceed 5 fps. Storm drain inlets shall be located so that no collection swales flow across a street or sidewalk to reach a storm drain, other than where cross gutters are used. Side opening catch basins are preferable. Where a grating must be used, it shall be of "bicycle proof'" design. Sidewalk culverts are not permitted.

4-4.2 Manholes. Manholes shall be located at intersections and changes in alignment or grade. Intermediate

manhole maximum spacing shall be 76.2 m [250 ft] for pipes 0.9 m [3 ft] or less in diameter or box drains with the smallest dimension less than 0.9 m [3 ft]. Maximum spacing for intermediate manholes on larger pipes and drain boxes shall be 152 m [500 ft]. Manholes shall be precast concrete and shall conform to ASTM C 478 or AASHTO M 199. Steel ladders shall be installed where the depth of the manhole exceeds 0.9 m [3 ft]. The ladder shall be galvanized after fabrication in accordance with ASTM A 123. The wall along the ladder shall be vertical. The manhole shall have a 0.6 m [2 ft] minimum opening as measured from the face of the steel ladder.

4-4.3 Drainage of roads and pavements. Provide a positive crown or sheet drainage to all streets and roads. Pavement collectors for storm water shall be by curb inlets and gutters. Open areas shall be drained by field inlets and an underground collection system. No roadside ditches shall be permitted. Overland flow shall be held to a minimum, where feasible. The maximum flow in all gutters shall be restricted to the quantity which will cause flooding of 1/2 the adjacent traffic lane at the design storm flow. When this flow is reached, it shall be intercepted and removed to an underground system. Inlets in the sag of vertical curves on streets that act as sumps shall be oversized 100%. Design shall be based on the Rational Formula and other criteria contained in ATTACHMENT 8.

4-4.4 Pipe for culverts and storm drains may be of concrete, clay, corrugated steel, corrugated aluminum alloy, PVC, or PE. Cement used in concrete pipe, fittings, manholes and other storm drainage structures shall be Type V.

4-5 Gas Distribution System. Gas lines are owned by City Public Service (CPS). CPS will design and construct the new gas distribution system and service lines, up to and including the meter. A gas regulator and meter to monitor fuel use shall be provided for each housing unit. The meter and regulator will be provided and installed by CPS. All new construction shall be coordinated with CPS. The Contractor is responsible for design and construction of service lines within in the units and the laterals connecting to the CPS installed meters. Service laterals shall be designed in accordance with local codes and CPS requirements. Gas lines shall comply with the requirements of ASME B31.8. Shutoff valves shall be provided on the exterior of each building. Contact CPS for determination of all costs associated with connection to the gas distribution system and meters. Existing lines that are to be abandoned shall be either removed or physically disconnected from all gas sources and purged. Abandoning existing gas piping shall be done in accordance with ANSI B31.8, Gas Transmission and Distribution Piping Systems. Installation of gas piping will be in accordance with ANSI B31.8 and 49 CFR 192.

4-5.1 Materials. Materials and appurtenances shall be free of defects and suitable to accomplish the stated objectives of gas distribution systems. Pipe shall be polyethylene or steel as described below.

4-5.1.1 Polyethylene pipe shall conform to ASTM D2513, Standard Specification for Thermoplastic Gas Pressure Piping Systems, with fittings complying with either ASTM D2513 or ASTM D2683, Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing. Connections to metal pipe shall comply with ANSI B16.5, Pipe Flanges and Flanged Fittings, or manufacturer's recommended standards.

4-5.1.2 Steel pipe shall conform to ASTM A 53, Grade A or B, Type E or S, Schedule 40; or seamless or electric resistance welded, Schedule 40; black, as specified in ASME B31.8. Furnace butt welded pipe may be used in sizes 40 mm [1-1/2 inch] and smaller. Fittings 40 mm [1-1/2 inch] and smaller shall conform to ASME B16.11. Pipe flanges and flanged fittings larger than 40 mm [1-1/2 inch], including bolts, nuts, and bolt patterns shall be in accordance with ASME B16.5, Class 150. Butt weld fittings shall be in accordance with ASME B16.9. Weld neck flanges shall be used.

4-5.2 Testing. Prove that the entire system of gas mains and service lines is gas-tight by an air test, in accordance with ANSI B31.8. The test shall continue for at least 24 hours between initial and final readings of pressure and temperature.

4-5.3 Drips. Unless high pressure natural gas is used, drips shall be installed at the low points, immediately

following reduction from high pressure to medium pressure (at supply points) and at occasional low points throughout the system to provide for blowing out the lines.

4-5.4 Valves. Plug valves shall be installed at intersections of mains and other locations so that interruptions to service can be confined to no more than 30 housing units.

4-5.5 Mains and service lines. Lines shall not be placed under any buildings. Lines shall be placed with a minimum of 0.6 m [2 ft] of earth cover. Protective casings shall be provided to protect lines from superimposed street or heavy traffic loads.

4-6 DELETED

4-8 Electrical Distribution. Connection to the existing aerial **(AM#2) or underground** medium voltage electrical distribution system shall be made as directed by the Ft. Sam Houston exterior electrical shop. Point of contact is Jaime Machado at 210-221-3350. Existing aerial **(AM#2) or underground** power lines on and around the site can be seen on the attached site drawings. **(AM#2) Aerial c**onnection shall be made utilizing hot line stirrups, surge arrestors, fused cutouts, terminators, rigid galvanized steel conduit riser, and all other necessary hardware for a complete installation. **(AM#2) Underground connection shall be as directed by the exterior electrical shop.**

4-8.1 System Design. The electrical on-site distribution system shall be designed in compliance with the rules and recommendations of ANSI C2, National Electrical Safety Code; NFPA 70, National Electrical Code whichever is more stringent; and ANSI C84.1, Electric Power Systems and Equipment – Voltage Ratings. Provide new electrical distribution system as necessary and connect to existing system. Distribution system shall be a load-balanced 3-phase loop-primary radial system incorporating a minimum of two sectionalizers. Sectionalizer feeder loads shall be as balanced as possible. Primary feeder cables shall be copper or aluminum. Medium voltage conductors shall have protective shielding. Use of concentric neutral type cable is not allowed. Medium voltage conductors shall be buried a minimum of 1.2 m [4 ft] below the finished grade with continuous cable marker tape 0.3 m [1 ft] below grade. Cable markers shall be installed along the length of direct-burial cable runs to identify their routes from the surface. Markers will be provided at changes of direction and at intervals not to exceed 152.4 m [500 ft]. Underground direct-burial distribution is required.

4-8.2 Underground splices. Underground connection or splices are prohibited, except in boxes or manholes. Splices shall be in a self-draining, rodent-resistant manhole or box with a cover.

4-8.3 Secondary Feeders. Each transformer shall feed a single secondary underground type distribution pedestal (free standing, pad-mounted enclosure with enclosed molded case breakers); and each pedestal shall feed underground service laterals (to allow disconnection of power to individual houses), street lighting, etc.

4-8.4 Secondary Distribution Pedestals. Pedestals shall have a circuit breaker panel with a main circuit breaker and branch circuit breakers for each housing unit service, street lighting circuit, etc. The pedestal load center shall be rated for the available fault current from the transformer. The load center enclosure shall be both NEMA 3R and NEMA 12. Enclosure shall be capable of being locked. The pedestal line terminals and the circuit breaker panel bus shall, as a minimum, be rated for 125% of the maximum nameplate output of the connected transformer.

4-8.5 Service laterals. Service laterals shall be underground. The length of secondary distribution service laterals from the transformer secondary to the building service entrances shall be minimized. Voltage drop in each service lateral shall not exceed three percent at the calculated maximum demand load. Service laterals shall be sized to supply no less than the largest total demand load as determined by the National Electrical Code, Article 220, Part B or Part C, whichever is greater. However, an additional 88 percent demand factor may be applied to laterals that feed buildings with two or more dwelling units.

4-8.6 Service entrance. Only one service entrance per building shall be provided. The service entrance conductor shall be buried a minimum of 0.9 m [3 ft] below finished grade with a minimum separation of 0.3 m [1

ft] from telephone or TV cables. System shall be designed such that the fault current available at the service entrance equipment will not exceed 10,000 amps.

4-8.7 Transformers. Transformers shall be pad-mounted and have two non-fused switches for the loop connection. The high voltage compartment of the transformer shall include a load break switch with fused circuit for the transformer. The transformer secondary voltages shall be 120/240 V, single-phase, three-wire, solid neutral service to housing units. In selecting a transformer, the nameplate rating shall not be less than 90 percent of the kilovolt/amperes (kV/A) demand load calculated for the transformer. Demand load shall be calculated by the method listed in the National Electrical Code, Article 220, Part B or Part C, whichever is greater.

4-8.8 Street, sidewalk, and area lighting. Residential roadway lighting, including collector streets, shall be provided. Provide lighting at roadway intersections, and at intervals not exceeding 60.9 m [200 ft] between intersections. Roadway poles and fixtures shall match existing poles located at the intersections along the northwest boundary of the site. Lighting shall be provided at intervals not exceeding 60.9 m [200 ft] along sidewalks not otherwise illuminated. Sidewalk poles (approximately 4 m tall) and fixtures shall match existing found in the residential area adjacent to the site. Area lighting shall also be provided for all playgrounds and tot lots. Luminaries shall be actuated by photoelectric control, one photocell per circuit, and supplied from multiple circuits originating from secondary distribution pedestals. All lighting levels shall be provided in accordance with the IES Lighting Handbook. **Wooden poles are not allowed. (AM#4)**

4-8.9 Existing power lines. Existing aerial and underground medium voltage power lines traverse across the site and are identified on the attached site drawings. These lines shall be demolished and new lines shall be provided per Ft. **(AM#2) Sam Houston** exterior electrical shop.

4-9 Metering. Metering of utilities shall be provided as follows:

4-9.1 DELETED

4-9.2 Individual meter and meter drops. Individual utility meter drops (including water) shall be provided for each dwelling unit (duplexes contain two dwelling units). Provide electric watt-hour meters adjacent to the service entrance point. Provide manual by-pass jumper plates for each watt-hour meter socket. Locate utility meter drops in an area readily accessible by service personnel. Meters and meter bases shall be sight screened, and located to provide convenient access while not distracting from building appearance.

4-9.3 Gas metering. Individual housing unit metering devices, which comply with local requirements, shall be furnished and installed by CPS. Separate meters shall be provided at duplexes. Meter and regulator location shall be sight screened, and located to provide convenient access while not distracting from the appearance of the units.

4-9.4 Water meter requirements. Water meters are required at each unit. Separate meters shall be provided at duplexes. Each water meter shall be sized to provide 1.26 liters per second @ 34.5 kPa loss (20 gpm @ 5 psi loss) and shall be the nutating disc type, bronze case, bronze disc, straight reading register (gallons).

4-10 Telephone. The **(AM#2) local t**elephone company **(AM#2)** _____ will furnish and install distribution cables **(AM#2) and all other materials needed to provide telephone service to each dwelling unit up to the protected telephone terminal ("Demarcation Box") located on the side of each dwelling unit. Contractor is responsible for contacting the local telephone company during design and implementing the local telephone company's cable distribution design into the electrical site plan. Contractor shall provide the local telephone company the site design to enable the local telephone company to produce a telephone cable distribution design. During construction, contractor shall coordinate with local telephone company and allow local telephone company on the site to install their cabling and other necessary materials to provide telephone service to each dwelling unit. Local telephone company is Southwestern Bell. Primary POC for Southwestern Bell is Ms. Linda Zugina at 210-483-3966. Secondary POC is Mr. Simon Martinez at 210-483-3959.**

4-10.1 **(AM#2) All e**xisting aerial/underground telephone cables **(AM#2) that** traverse through the site **(AM#2) will be located and identified by FT. Sam Houston to enable contractor to relocate affected cables as part of the design. It is the contractor's responsibility to ensure this is done. Ft. Sam Houston POC for this is Mr. Carlos Santillan at 210-221-1418. The attached electrical site drawings identify some, but most likely not all existing cables**. **(AM#2)** **After cables have been identified, contractor's cable relocation design** shall be coordinated with the Ft. Sam Houston Information Technology Business Center (ITBC). POC is Mr. Rick Coleman at 210-221-5955. Outage allowance shall be per Ft. Sam Houston ITBC.

4-10.2 **(AM#2) Deleted.**

4-11 Television. A cable TV distribution system shall be provided for each dwelling unit. There is an existing cable TV distribution system located in the vicinity of the east and west sides of the site. Local cable TV Company shall provide contractor with a connection point(s) to these existing systems. Contractor shall provide all trenching and backfilling in accordance with local cable TV Company requirements. All other materials required for a complete and operable system other than those listed in section 9 will be furnished and installed by the local cable TV company. Close coordination between the contractor and the local cable TV Company shall be maintained throughout the entire design-build process. Local cable TV Company is Time Warner. POC for Time Warner is Peter Perez at 210-352-4466. E-mail address for Mr. Perez is Peter.Perez@twcable.com.

4-12 Cathodic Protection. Cathodic Protection (CP) is mandatory on buried ferrous metallic structures as described below:

4-12.1 Department of Transportation guidance as stated in 49 CFR, Part 192, requires that all metallic natural gas piping be coated and cathodically protected regardless of the soil resistivity.

4-12.2 CP systems must be designed to provide protective potential to meet the requirements of the National Association of Corrosion Engineers (NACE) Standard RP-0169, Control of External Corrosion on Underground or Submerged Metallic Piping Systems, or NACE Standard RP-0185, Control of External Corrosion on Metallic Buried, as appropriate.

4-12.3 New CP systems shall be compatible with other adjacent structures or components.

4-12.4 When plastic pipe is used to extend a steel gas distribution main, an insulated No. 8 AWG copper wire shall be exothermically welded to the existing steel main and run the length of the new plastic main. This wire can be used as a locator tracer wire and to maintain continuity to any future steel gas main extension.

4-12.5 CP and protective coatings shall be provided for the following buried and submerged ferrous metallic structures regardless of soil or water resistivity:

4-12.6.1 Natural gas and propane piping.

4-12.6.2 DELETED

4-12.6.3 DELETED

4-12.6.4 Fire protection piping.

4-12.6.5 Ductile or cast iron pressurized piping under floor (slab on grade) in soil.

4-12.6.6 Underground heat distribution and chilled water piping in ferrous metallic conduit.

4-12.6.7 DELETED

4-12.7 Cast iron pipe shall be treated as follows:

4-12.7.1 For soil resistivity below 10,000 Ohm-cm at pipeline installation depth, provide CP, bonded joints, and protective coatings.

4-12.7.2 For soil resistivity between 10,000 and 30,000 Ohm-cm at pipeline installation depth, provide bonded joints only.

4-12.8 Copper water service lines will be dielectrically isolated from ferrous pipe. Dielectric isolation shall conform with NACE RP-0286.

4-12.9 For ductile iron piping systems (except for ductile iron piping under floor in soil) conduct an analysis to determine if CP and/or bonded or unbonded coatings are required. Unbonded coatings are defined in ANSI/AWWA C105/A21.5.

4-12.10 Conduct an economic analysis to determine if CP and protective coatings should be provided for gravity sewer lines and the following structures in soil resistivity conditions above 10,000 Ohm-cm:

4-12.10.1 Potable water lines.

4-12.10.2 Concentric neutral cable.

4-12.10.3 Other buried and submerged ferrous metallic structures not covered above.

4-12.11 Ferrous metallic piping passing through concrete shall not be in contact with the concrete.

5. UNIT DESIGN - ARCHITECTURE.

5-1 Unit Design. The architectural work includes the design and construction of 70 housing units. 20 SrNCO units and 50 JrNCO units are to be constructed. The SrNCO dwelling units are to be single story or two story, three bedroom detached houses. The JrNCO units are to be single story or two story, four bedroom detached houses or duplexes.

5-2 These dwellings shall convey a visual image consistent with Fort Sam Houston's design characteristic and it's physical organization. The dwellings are to be part of the New Post, zone 2a. The dwellings are to be compatible with the Noncommissioned Officers Quarters' massing, proportion and scale and material and color, window and doors, and details. The New Post, zone 2a definitions are established in the Fort Sam Houston Design Guide (FSH DG). Also covered in the FSH DG are exterior guidelines and interior guidelines.

5-3 Designs shall provide unit net areas which do not fall below the minimum values shown in the table below.
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TABLE 5-1

Pay Grade	Number Of Bedrooms	Minimum Net Floor Areas	
		m^2	ft^2
O-1/3 (CGO) W-1/4 E-7/9 (SNCO)	3	125	1,350
E-1/6 (JNCO)	4	125	1,350

5-3.1 Net area definition. Net area is defined as the space inside the exterior and party walls. Net area excludes:

5-3.1.1 Exterior and party walls.

5-3.1.2 Half thickness of interior walls adjacent to excluded areas.

5-3.1.3 Utility and laundry rooms.

5-3.1.4 Interior and exterior bulk storage.

5-3.1.5 Washer and dryer closet.

5-3.1.6 Furnace, domestic water heater, and solar equipment spaces.

5-3.1.7 Stairwells.

5-3.1.8 Landings.

5-3.1.9 Walls and interior spaces specifically designed for passive solar systems (other than required habitable areas).

5-3.1.10 Weather vestibules (not to exceed 1.5 m^2 [16 ft^2]) sheltering the main entry.

5-3.1.11 Unfinished attic and basement space.

5-3.1.12 Patios or balconies and terraces.

5-3.1.13 Carports and garages.

5-3.1.14 Increases required to meet accessibility standards.

5-3.1.15 Open or screened porches without heating, air conditioning, or interior-type finishes. In localities subject to adverse weather conditions, such as wind-driven mist or noxious atmosphere, or both, open porches may be enclosed with appropriate fenestration or screening, or both, and not considered to increase the net area of the housing units, provided that air conditioning or heating, or both, is not added and the basic character of the enclosed area is still that of a porch.

5-3.2 Allowable net area increases. The minimum net floor area is noted in table 5-1. Proposals to increase the net area of the SrNCO dwellings will be considered a betterment. SrNCO dwellings may increase by 15% of the area shown in table 5-1, while lowering the total number of SrNCO dwellings by 10%. 18 SrNCO dwellings may be constructed if each contains **143.75 square meters (1552.5 net square feet) (AM#4)**. The net area increase does NOT apply to the JrNCO dwellings.

5-3.2.1 5% of the dwelling units are to be ADA accessible. Physical limitations may include any of several types of disabilities. The unit should anticipate a variety of conditions. Accessible housing units shall be designed in such a way that they may be easily and readily modified to accommodate physically challenged occupants, if necessary, at time of occupancy. This means required access clearances, room sizes, bathroom layout, kitchen layout, doors and hardware, grab bars, plumbing hookups, light switches and outlets, controls, and warning devices must meet requirements at time of construction. Readily modifiable means that requirements for adjustable height cabinets and work surfaces, plumbing fixtures, and the warning devices for the hearing and visually impaired can be made either at time of construction or at time of occupancy.

5-3.2.2 Deleted

5-3.2.3 Deleted

5-4 Functionality. Rooms shall be sized and arranged for efficient use, good circulation, and furniture placement. The distribution of space for food preparation living and dining, sleeping, bathing, halls, closets, and services should be balanced and should enhance the intended functions. The master bedroom shall be isolated from the other bedrooms. The submitted floor plan shall pursue an open plan between the kitchen, living and dining room.

5-4.1 Habitable rooms shall not be used as halls for entry into a housing unit or for primary circulation within a housing unit.

5-4.2 Provide convenient access between carport and service area, and between kitchen and service area.

5-4.3 Do not use a sliding glass door as a primary housing unit access.

5-5 Indoor and Outdoor Integration. Emphasize factors that enhance indoor and outdoor living. Consider size, layout and location of patios, balconies and yards, and features that encourage family use of outdoor areas.

5-6 Fire Protection and Safety. Housing units will comply with the applicable National Fire Codes, including NFPA 101, Life Safety Code, and the Mil Hdbk 1008C, Fire Protection for Facilities. Construction features will be provided in accordance with the International Building Code (IBC).

5-6.1 Fire resistance of walls and roof material. Walls separating living units from exterior bulk storage shall be of U.L. design for 1-hour fire rating partitions and shall extend from ground to the underside of the roof sheathing, as a single design assembly. Penetrations in the fire rated partitions shall maintain the rated integrity. This requirement shall be in addition to any code requirements. Provide class A (ASTM E 108, Standard Methods of fire tests of roof covering) roof covering material throughout. party walls and roof material. Party walls shall extend without openings, from ground to the underside of roof sheathing. Provide firestops at floor, and ceiling or roof line. Provide Class A (ASTM E108, Standard Methods of Fire Tests of Roof Coverings) roof covering material throughout. Party walls (walls separating housing units) shall have the minimum fire-resistance ratings shown below:

5-6.1.1 Duplexes, one hour.

5-6.1.2 Deleted.

5-6.1.3 Deleted.

5-6.2 Party floors. Party floors shall have a topping slab of 50 mm [1-1/2 inch] lightweight concrete, or similar material. Party floors shall have a minimum one-hour fire-resistance rating, in accordance with ASTM E119.

5-6.3 Equipment rooms. Rooms equipped with fuel-fired equipment such as boiler rooms, furnace rooms, and rooms with fuel-fired water heaters, which serve more than one housing unit shall be separated by one-hour fire-rated construction. Direct access to these rooms from the exterior is preferred. Rooms with fuel-fired equipment that serve only one housing unit shall be lined with 13 mm [1/2-inch] gypsum board or equivalent noncombustible material.

5-6.4 Alarm systems. Smoke detectors which are located within the housing unit and which sound an alarm only within the housing unit are not required to be transmitted to the installation fire department.

5-6.5 Deleted.

5-7 Sound Attenuation.

5-7.1 Testing. Certified proof-of-performance field tests will be conducted to demonstrate that the floor and wall systems as constructed provide the required sound isolation. Tests for air-borne sound shall be made in compliance with ASTM E336. Tests for impact sound shall be made in compliance with ASTM E1007. Testing of 10 percent (minimum) of each type of floor and wall system is required. Location of test sites will be chosen at random by the Contracting Officer.

5-7.1.1 Any wall or floor system found to be inadequate shall have the deficiencies corrected and the additional qualifying tests conducted at the Contractor's expense. Testing at the Contractor's expense of greater than 10 percent of each system may be required if the Contracting Officer determines that the quality of construction requires this additional testing.

5-7.1.2 Walls and floor ceiling systems shall be designed to meet or exceed the requirements stated below. In cases where the field tested performance of the systems does not meet the designed performance, the maximum acceptable difference between field tests and sound transmission ratings shall be 2 decibels (dB) for airborne sound ratings and 5 dB for impact sound ratings.

5-7.2 Party walls and floor and ceiling construction between housing units (party floors) shall be designed to provide the minimum airborne sound transmission ratings and impact isolation ratings stated in Table 5-2.

TABLE 5-2 - SOUND TRANSMISSION STANDARDS FOR PARTY WALLS AND FLOOR/CEILING CONSTRUCTION

Area	FSTC[1]	FIIC[2]
Party Walls (Unit Separation)	52	
Primary Habitable Areas (Living, Dining, Family Room, Bedrooms, Circulation)	52	
Habitable Wet Areas (Kitchen, Bath, Utility, Laundry, Equipment)	52	-

Note[1]: Field Sound Transmission Class. See ASTM E336.

Note[2]: Field Impact Isolation Class. See ASTM E1007.

5-7.3 Floor construction. Floor construction between occupancies shall be designed to provide the minimum FSTC and FIIC ratings stated in Table 5-2. Materials used to obtain the required sound attenuation for the floor construction shall not be liquid-soluble or softened by moisture. Sound insulation shall have a flame-spread rating of 25 or less and a smoke development rating of 50 or less when tested in accordance with ASTM E84.

5-7.4 Plumbing and HVAC equipment. Design of plumbing and Heating, Ventilating, Air-Conditioning (HVAC), and dehumidifying equipment shall include design provisions such as location, enclosure and acoustical treatment, to minimize transmission of noise generated by equipment within each housing unit and to eliminate transmission of noise to other housing units.

5-8 Dimensions and Areas. Minimum areas and dimensions for interior spaces are shown in Table 5-3. Minimum areas and dimensions for exterior spaces are shown in Table 5-4.

TABLE 5-3 - MINIMUM AREAS AND DIMENSIONS - INTERIOR SPACES

Space	Area		Length		Width/Depth		Height[1]
	m^2	ft^2	mm	ft-in	mm	ft-in	mm
Living[2]	14.0	150	3550	11-8	3550	11-8	2300
Dining (/3 BR)[2]	8.4	90	2900	9-6	2900	9-6	2300
Dining (4/ BR)[2]	10.2	110	3200	10-6	3200	10-6	2300
Family Room[2]	8.4	90	2900	9-6	2900	9-6	2300
Kitchen[3,6]	6.0	64	2450	8-0	2450	8-0	2300
Eating in Kit.[4]	6.7	72	2600	8-6	2600	8-6	2300
Refrigerator & Freezer	0.5	6	900	3-0	600	2-0	1800
Washer/Dryer[5]	1.7	18	1800	6-0	900	3-0	2300
BR #1	14.0	150	3550	11-8	3550	11-8	2300
BR #2	11.1	120	3000	10-0	3000	10-0	2300
BR #3	9.0	100	3000	10-0	3000	10-0	2300

TABLE 5-3 - MINIMUM AREAS AND DIMENSIONS - INTERIOR SPACES

Space	Area		Length		Width/Depth		Height[1]
	m^2	ft^2	mm	ft-in	mm	ft-in	mm
BR #4/5	8.4	90	2900	9-6	2900	9-6	2300
Full Bath[6]	-	-	-	-	1500	5-0	2300
Equipment room[8]	**- (AM#4)**	**- (AM#4)**	-	-	-	-	2300
Vestibule	1.2	13	1000	3-3	1200	4-0	2300
Hall & Stairway[7]	-	-	-	-	1000	3-3	2300

Note[1]: Ceiling heights in habitable rooms shall be a minimum of 2300 mm [7 ft-6 inches]. Ceiling heights can be reduced in parts of these rooms to 2100 mm [7 ft] to accommodate ducts.
Note[2]: Room dimensions are exclusive of circulation. Circulation paths along one side of a room are permitted but add 1000 mm [3 ft-3 inches] to the minimum dimension.
Note[3]: A minimum of 1200 mm [4 ft] must be maintained in front of and between cabinets.
Note[4]: Minimum area and dimensions are measured from face of cabinets to walls.
Note[5]: Minimum area and dimensions are indicated for a washer and dryer closet. This area may also be provided in a utility room. When so provided, area and dimensions are exclusive of circulation.
Note[6]: Accessible units must conform to UFAS. UFAS requires greater minimum dimensions.
Note[7]: Clear width is measured between railings.
Note[8]: The length and width/depth shall accommodate the equipment installed and any required area to access and maintain the equipment.

TABLE 5-4 - MINIMUM AREAS AND DIMENSIONS - EXTERIOR SPACES

Spaces	Area		Length		Width/Depth		Height[1]
	m^2	ft^2	mm	ft-in	mm	ft-in	mm
Carport (AM#2)	21.6	240	3650	12-0	6100	20-0	2300
Balconies	6.7	72	1800	6-0	1800	6-0	2300
Patio - 3 BR	13.6	144	-	-	3000	10-0	2400
Patio - 4 BR	17.0	180	-	-	3000	10-0	2400

Note[1]: Ceiling heights apply when patios and balconies are covered.

5-8.1 Minimum area requirements for kitchen cabinets, counters, and pantries are shown in Table 5-5. Flat area is shown for countertops and drawers. Combined shelf area is shown for pantry and base, wall and wall cabinets.

TABLE 5-5 - KITCHEN CABINET, COUNTER, & PANTRY AREA

Type of Housing Unit	Wall		Base		Drawer		Counter		Pantry	
	m^2	ft_2	m^2	ft^2	m^2	ft^2	m^2	ft^2	m^2	ft^2
Others 4 BR	2.8	30	3.8	40	1.7	18	1.5	16	1.5	16
Others 3 BR	2.3	24	3.0	32	1.3	14	1.1	12	-	-

5-8.2 Minimum closet width requirements are stated in Table 5-6. **(AM#4)**.

TABLE 5-6 – MINIMUM CLOSET WIDTHS[1] (AM#4)

Type of Unit	EM	
	Mm	Ft
Coat/ Entry Hall	900	3
Master[2] BR #1	1800	6
BR #2	1200	4
BR #3	1200	4
BR #4	1200	4
Broom	900	3

Type of Unit	EM	
	Mm	Ft
Linen[3]	600	2

Note[1]: Minimum inside clear depth for standard/broom closets shall be 600 mm [2 ft].
Note[2]: Walk-in closet is preferred.
Note[3]: Minimum clear inside depth for linen closets shall be 430 mm [1 ft-6 inches].
(AM#4)

5-8.3 Minimum requirements for interior, exterior, and combined bulk storage are shown in Table 5-7.

TABLE 5-7 – MINIMUM INTERIOR, EXTERIOR, & COMBINED BULK STORAGE[1] (AM#4)

Type of Unit	Type of Storage	EM	
		m^2	ft^2
3 BR	Int.	3.0	32
	Ext.	3.7	40
	Comb.	7.9	85
4 BR	Int.	3.7	40
	Ext.	4.5	48
	Comb.	9.3	100

Example[1]: If interior bulk storage is 2.3 m^2 , then exterior bulk storage must be 4.2 m^2 to obtain the combined bulk storage requirement of 6.5m^2. (AM#4)

5-9 Major Zones. Living and Dining, Kitchen, Family Room, and Bedrooms.

5-9.1 Living and dining. The living room should have direct access to the front entrance foyer and to the dining area without passing through another room. When circulation is required along the perimeter of the space or between areas in open plans, minimum circulation space of 1000 mm [3 ft-3 inches] shall be added to the required minimum room dimension.

5-9.1.1 The dining area may be an extension of, or an "L" off the living room.

5-9.1.2 The dining area shall be directly accessible from the kitchen without passing through another room.

5-9.1.3 For Senior Officer family units, provide separate dining rooms or areas to accommodate furniture and seating for not less than 10 persons.

5-9.2 Kitchen and auxiliary dining area.

5-9.2.1 The kitchen shall provide an efficient work triangle. A base cabinet, minimum 380 mm [15 inches] wide, shall be provided on the handle side of the refrigerator. The range shall not be located adjacent to the refrigerator, in a corner, or adjacent to a passageway. The dishwasher shall be installed adjacent to the kitchen sink. Provide a backsplash behind the range, extending to the underside of the range hood, finished to match the countertop or range and the range hood. Space for a tenant-owned upright freezer shall be provided adjacent to the kitchen or in areas such as the utility room **(AM#4)**. Space for a tenant-owned microwave oven shall be provided in the kitchen by way of a microwave cabinet.

5-9.2.2 Provide auxiliary dining areas in the form of table space in the kitchen or in a family room adjacent to, or as an extension of, the kitchen. The auxiliary dining area shall not be located in the living or dining rooms.

5-9.2.3 In the kitchen, shoe molding (1/4 round) is required at all base cabinets where they meet the floor surface.

5-9.3 Family room. Provide a separate family room, adjacent to and contiguous with the kitchen, for all three-, four-bedroom units.

5-9.4 Bedrooms. Bedrooms shall be designed to accommodate king-size beds in master bedrooms and twin beds in the other bedrooms. Window, door, and closet placement should enhance furnishability. Each bedroom shall be accessible without passing through another bedroom.

5-10 Minor Zones. Bathrooms, Laundry, Closets, and Bulk Storage.

5-10.1 Bathrooms. Emphasis shall be placed on size, furnishings, layout, and privacy. Direct access to a bathroom from the master bedroom is required for three- and four- bedroom units. Compartmented bath design, for family and guest use, is encouraged. Determine the number of bathrooms based on Table 5-8.

TABLE 5-8 - BATHROOM REQUIREMENTS

Number of Bedrooms per Floor	Number of Bathrooms Per Floor
3 - 5	2

5-10.1.1 A full bath shall contain a water closet, lavatory, and either a tub with shower assembly or a shower stall. One full bath in each housing unit shall include a tub with shower assembly and shall be directly accessible from the bedroom hall without passing through another room. Showers, and tubs with shower assemblies, shall include shower curtain rods with curtain rings. A half bath contains a lavatory and a water closet.

5-10.1.2 Provide lavatories mounted in 610-mm [2-ft] wide (minimum) countertops, with vanity bases. Countertops shall be high pressure laminated plastic, ceramic tile, marble, or homogeneous, non-porous, solid surface type materials, with minimum 100 mm [4 inches] high back splashes. Maximize vanity storage space.

5-10.1.3 Bathroom accessories may be surface mounted or recessed, of non-corrodible metal or ceramic tile, and shall include a toilet paper holder, soap dish (at sink and at tub/shower), toothbrush and tumbler holder, and grab bar at tub or shower stall, bathrobe hook, and towel bars totaling not less than 1100 mm [42 inches] for a full bath and not less than 750 mm [30 inches] for a half bath.

5-10.1.4 A mirror glass above the vanity and a recessed medicine cabinet shall be provided in each bathroom. Cabinets shall be corrosion-resistant with plate glass mirrors, sliding or hinged door type. Do not place recessed medicine cabinets in party walls.

5-10.1.5 Tubs and showers shall not be placed under windows.

5-10.1.6 Exhaust shall be provided in all baths, shall be ducted directly to the exterior of the building, and shall be a part of an engineered ventilation system (See paragraph 10).

5-10.2 Laundry. Washer and dryer space may be provided in an enclosed recess off the hall in two-bedroom units. Three-bedroom and larger units shall have a separate utility room.

5-10.2.1 The space provided shall have doors that provide full access when open. A minimum of two full-length shelves, 250 mm [10 inches] minimum nominal depth, are required above the washer and dryer.

5-10.2.2 Minimum net clear door width to washer and dryer space when open is 1600 mm [5 ft-4 inches] for an enclosed recess and 800 mm [2 ft-8 inches] if located within a utility room. Doors shall be either undercut or louvered to provide adequate make-up air for the dryer in accordance with typical household.

5-10.3 Closets. Closets shall provide the minimum widths indicated in Table 5-6. A broom closet shall be provided convenient to the kitchen, and a coat closet shall be located convenient to the housing unit entrance.

5-10.3.1 Closet shelving. Closets (except linen closets) shall be equipped with a 305 mm [12 inches] deep shelf and a clothes hanger rod. Linen closets shall be provided with at least four full-depth shelves. Closet shelving and rods in excess of 1200 mm [4 ft] shall have center supports. Shelves and supports shall be capable of carrying 52 kg/m [35 lbs/ft]. Closet shelving shall be minimum 19 mm [3/4 inch] thick solid wood, plywood, or high-density particleboard. Factory Finished welded wire shelving shall not be used.

5-10.3.2 Closet doors. Closet doors should be located to permit placement of furniture in the corners of the rooms by providing a 460-mm [18-inch] return adjacent to a furnishable wall. Closets 1800 mm [6 ft] or more in width shall have sliding doors, maximum 2000 mm [6 ft-8 inches] high. Wall closet width shall not extend beyond either doorjamb more than 510 mm [20 inches]. Wardrobe closet doors (sliding and bi-fold) shall be provided with both top and bottom door tracks. Accordion doors are not permitted.

5-10.4 Bulk storage. Provide each housing unit with interior and exterior bulk storage space meeting the minimum requirements of Table 5-7. Provide interior storage in a separate room or included as an extension of the utility room when one is provided. Provide exterior storage in **(AM#4)** a separate exterior enclosure, or within the housing unit with access from the exterior. Exterior storage space shall be lockable.

5-10.4.1 Utility room. The utility room may contain a utility sink. The utility room should be located adjacent to the rear entrance. If a utility sink is not submitted a hose bib will be located near the rear entrance at a hardstand.

5-10.4.2 Bulk storage space should be at least 1200 mm [4 ft] in depth and a minimum clear height of 2000 mm [6 ft-6 inches], except that space under stairs may be counted at 1/2 area if the space is 1200 mm [4 ft] or more in height.

5-10.4.3 Provide a minimum of three nominally 305 mm [12 inches] deep shelves with a combined length of 7300 mm [24 ft] within each bulk storage room.

5-10.4.4 Common walls and ceilings between adjacent storage areas shall be finished on both sides.

5-10.4.5 The equipment room shall contain heating and cooling systems equipment. The equipment room shall be accessible from the exterior. Consideration should be given to design accessibility to the equipment room by maintenance personnel even after the resident fences in the yard at a later date. There shall be a lighted dry covered flat surface for maintenance personnel to work. The HVAC filters are to be accessible from within the dwelling.

5-11 Interior Finishes

5-11.1 Provide three interior color/finish schemes.

5-11.2 Walls and ceilings. Provide a minimum of 13 mm [1/2-inch] gypsum wallboard, taped and smooth or orange peel finished. Water-resistant wallboard shall be used in wet areas such as bath, powder, and laundry rooms. Cementitious backer board shall be used for ceramic tile applications. An orange peel ceiling finish may be provided in areas other than kitchen, laundry, or bathrooms. Interior finish shall have a flame-spread rating of 25 or less and a smoke-developed rating of 50 or less when tested in accordance with ASTM E84. Clear acrylic corner guards may be used to protect corners. Wallpaper shall not be used.

5-11.3 Kitchen and eating area walls and ceiling. Combined kitchen and eating rooms shall have the same type of wall and ceiling finishes.

5-11.4 Flooring and stairs, base, and carpet. Kitchen, laundry, and utility flooring shall be sheet, seamless vinyl with wood base. Bedrooms may contain sheet vinyl with wood base but prefer wood flooring. The hall, and living-dining area flooring shall be sheet vinyl with wood base or vinyl composition tile with wood base. Wood flooring or a factory-made, prefinished wood plank floor with wood base in the living-dining area will be considered a betterment. Bathrooms shall be of ceramic tile flooring with ceramic tile base or seamless sheet vinyl with wood base. Interior stairs shall be hardwood with clear finish, or softwood with carpet. Additional consideration will be given to designs which incorporate ceramic tile bathroom floors and hardwood stairs with a clear finish. This material identification is not justification to exceed the mandatory price limitation set forth in this solicitation.

5-11.4.1 Vinyl composition floor tile shall conform to ASTM F1066, Standard Specification for Vinyl Composition Floor Tile, and have a minimum thickness of 2.381 mm [3/32-inch].

5-11.4.2 Sheet vinyl shall conform to ASTM F1303, Standard Specification for Sheet Vinyl Floor Covering with Backing, Type II, Grade 2. Flooring shall be installed as a monolithic material with seams welded or bonded for a seamless installation. No seams shall be permitted in spaces less than 12 feet in width.

5-11.4.3 Ceramic tile shall conform to ANSI 137.1, moderate or heavy grade.

5-11.4.4 Carpet shall be installed in the stretch method over carpet pad utilizing tackless strips in accordance with CRI-104. Carpet shall meet the following criteria:

5-11.4.4.1 Properties: Tufted construction, 100 percent branded continuous filament nylon or polyethylene theraphthalate, soil hiding, multi-colored, loop or cut pile, 1/8 guage, yarn weight 800 grams per square meter [28 ounces per square yard], total weight grams per square meter [60 ounces per square yard], 5000 minimum density, synthetic primary and secondary backing.

5-11.4.4.2 Tuft bind for tufted carpet shall meet a minimum of 44 N (10 pounds) when tested in accordance with ASTM D1335, 1967; R-1972

5-11.4.4.3 Carpet shall meet requirements of 16 CFR 1630 and have a minimum average critical flux of .45 watts per square centimeter when tested in accordance with ASTM E648.

5-11.4.4.4 Deleted

5-11.4.4.5 Ten-year warranty from the carpet manufacturer against edge ravel, delamination, and tuft bind.

5-11.4.4.6 Carpet pad shall be 1/2 inch bonded urethane, minimum 6-pound density. Urethane pad will conform to ASTM.D.3676.

5-11.4.4.7 Carpet edging shall be 38 mm [1-1/2-inch] minimum width floor flange and minimum 15.5 mm [5/8-inch] wide face.

5-11.4.4.8 Tackless strip for stretch-in installation over carpet pad shall be exterior grade Douglas Fir

plywood, with minimum dimensions of 29 mm by 7 mm [1-1/8-inch wide] suitable for the cushion thickness specified. Tackless strips with two or three rows of staggered pins shall be used. For areas over 6100 mm [20 ft] long, tackless strip with three rows of pins shall be used. Pins of the proper length shall be provided to penetrate through carpet backing, but shall not be a safety hazard.

5-11.4.4.9 Carpet containing recovered material is designated in 40 CFR 247.12 as an affirmative procurement item. Products containing recovered material will be provided when price, performance, and availability meet project requirements. Various nylon and polyethylene terephthalate carpet offer the opportunity to meet this requirement.

5-11.5 Painting. Primers, paints, and stains shall meet or exceed the requirements of Unified Facilities Guide Specification 09900, Paints and Coatings, provided in the Technical Specifications. The paint selected shall be scrub able. Finishes shall be lead free. **(AM#5)** Walls and ceilings in kitchen, baths, laundry, utility rooms, and all painted trim shall be painted with semi-gloss enamel. Colors shall be submitted by the Contractor and approved by the Contracting Officer. Blown-on acoustical finish is prohibited. Orange peel finish on gypsum walls and ceilings may be used.

5-12 Carport If trash or bulk storage areas are included in the carport, such areas are in addition to the required car storage area. Refer to Table 5-4 for minimum dimensions. Set the carport slab elevation a minimum of 100 mm [4 inches] below the level of the housing unit floor and the floor of the adjoining exterior storage. Slope slabs to drain away from the housing unit.

5-13 Roofing and Drainage. Slopes for the roofs are to maintain the **1:2 pitch (AM#3)** established at Patch-Chaffee.

5-13.1 Roof water. Gutters and downspouts shall be provided for all roof areas. The gutter system should minimize maintenance. The Design should prevent water run-off onto porous materials. Downspouts draining onto a lower roof shall have metal or plastic splash deflectors. Concrete splash blocks shall be provided under downspouts if not connected to the storm drainage system.

5-13.2 Roof surface. Emphasis shall be placed on low maintenance and durability of roof material. The number of roof penetrations shall be minimized. Wood shake or shingle roofs are prohibited. The following roof materials may be used, but are listed in declining order of preference.:

5-13.2.1 Deleted

5-13.2.2 Minimum of 245 kg [540 lb], standing or flat seam, metal roofing, **(AM#2)** factory finish. The metal roof assembly shall conform to UL580 class 90.

5-13.2.3 Clay, concrete tile.

5-13.2.3.1 Clay roofing tile shall be machine formed natural clay tiles, one piece “S” Mission, kiln-fired to vitrification and free from surface imperfections. Provide specially shaped, color-matched units as indicated or required for ridges, rakes and hips. Provide with cast-in anchor lugs, transverse weather checks and fastening holes.

5-13.2.3.2 Concrete roof tiles shall be extruded, interlocking concrete roofing tile units, shape as indicated, with integral color. Include specially shaped, color-matched units as indicated or required for ridges, rakes and hips. Provide with cast-in anchor lugs, transverse weather checks and fastening holes.

5-13.2.3.3 Underlayment shall be ASTM D 2178, Type VI.

5-13.2.4 Deleted

5-13.2.5 Deleted

5-13.3 Deleted.

5-14 Exterior Finishes. Emphasis shall be placed on low maintenance and durability for exterior finish materials. Materials shall be residential in size, scale, and texture. Exterior finish materials for exterior bulk storage buildings and **carports (AM#4)** will match the primary dwelling unit. The following siding materials may be used, but are listed in declining order of preference:

5-14.1 Stucco. Portland cement plaster or synthetic stucco shall have integral color. Stucco total surface area shall be divided into panels with control joints spaced no more than 300 mm [10 ft] apart to form a panel of less than 14 m^2 [150 ft^2]. Contractor shall follow manufacturer's installation instructions explicitly and shall certify accurate and correct installation of all stucco type materials.

5-14.2 Deleted

5-14.3 Deleted

5-14.4 Exterior Insulation Finish System (EIFS). EIFS may be used if high quality materials and installation checks are used. A drainage EIFS system shall be used. Provide a complete secondary weather barrier with a water-shedding drainage plane and flashings. Provide sealed isolation joints around all penetrations. Provide pan flashing at windows. Use wet-mix base coats. Use 6-ounce or heavier mesh. Use high-impact mesh at the ground level and in traffic areas. Use silicone sealants for joints. Contractor shall follow manufacturer's installation instructions explicitly and shall certify accurate and correct installation of all EIFS type materials.

5-14.5 Deleted

5-14.5.1 Deleted.

5-14.5.2 Deleted

5-14.5.3 Deleted.

5-14.5.4 Hardboard and cement asbestos shingle siding are not acceptable.

5-14.6 Trim elements. Aluminum or vinyl clad wood trim is preferred over painted or stained wood trim. Painted exterior surfaces shall be minimized. When exterior exposed wood trim is used, the following requirements apply:

5-14.6.1 Wood fascia and rakes are required and shall be 25 mm [1 inch] nominal boards with solid blocking or 50 mm [2-inch] nominal boards without blocking. Plywood, hardboard, or gypsum board are not permitted for fascias or rakes.

5-14.6.2 Exposed wood, such as window trim, door sills, window sills, railings and balusters, wood fencing, solar shading devices including louvers, arbors, and trellis shall be treated for rot resistance in accordance with NWWDA Industry Standards I.S.4, Water Repellant Preservative Treatment for Millwork.

5.14.6.3 Exterior surfaces requiring painting shall receive a minimum of one prime coat and two finish coats of paint. Wood trim frames, etc., shall be back primed. Exterior semi-transparent stains, two coats, are acceptable, where appropriate for wood, plywood, etc.

5-14.6.4 Mounting brackets shall be installed to accommodate a ¾" to 1" flag pole. The mounting bracket will be installed on the front side of the house at a convenient location for use.

5-14.7 Exterior ceilings and soffits. Exposure of roof framing and underside of roof/floor decks are not permitted. Exterior ceilings and soffits will be trimmed or otherwise architecturally treated and coordinated with

siding. Exterior ceilings and/or soffits may be prefinished metal, vinyl, plywood, or 9.5 mm [3/8-inch] 303 medium density overlay siding material, EXT-APA conforming to American Plywood Association Standard B840, 303 Siding Manufacturing Specifications. Cement asbestos ceiling or soffit are not permitted.

5-14.7.1 Mounting brackets for small satellite dishes. Metal mounting brackets are to be fastened to the roof framing structure at the soffit. The residents will furnish their own satellite dishes. One mounting bracket for each single family and two mounting brackets for each duplex shall be installed. The duplexes shall have the brackets located as not to require one neighbor to enter the other neighbors yard to access their respective bracket/dish. The dishes shall have an unobstructed path so as to achieve clear signals. The brackets are to be located on the rear elevation or one of the side elevations; whichever gives a clear unobstructed signal. The brackets are not to be located on the front elevation of any of the units. (AM#2)

5-14.8 Patios. Patios shall be sloped to drain and have a broom-finished concrete floor surface.

5-14.9 Balconies and porches and stoops shall be sloped to drain away from the unit and have a concrete floor surface which provides a waterproof and non-slip surface. Plastic coating or films over concrete decks are not acceptable. Exposed wood decks, stained or painted, are not acceptable. Balcony topping shall have a minimum thickness of 38 mm [1 1/2-inch] with welded-wire mesh reinforcement. Exposed wood rails and trim shall be treated to deter damage from moisture decay and insect infestation or be iron bar stock, painted with rust inhibiting black paint.

5-14.10 Exterior Stairs. Exterior stair treads and landings shall be constructed of concrete or steel, and provided with non-slip type treads. Exposed wood rails and trim shall be treated to deter damage from moisture decay and insect infestation or be iron bar stock, painted with rust inhibiting black paint.

5-15 Glazed Openings. Windows and glazed door (50 percent or more glass) units shall meet the following standards and must be certified by an independent testing laboratory. Windows that slide (double-hung, single-hung, and horizontal sliding) and glass exterior doors shall meet the standards for hung units. Standards for casement windows shall apply to all hinged or fixed windows. Other window types may be used if they have been tested and conform to the standards for hung windows. The Contractor shall provide the manufacturer's certification that the window provided meets the following test requirements:

5-15.1 Required tests. Hung units will meet a National Fenestration Rating Council (NFRC) design pressure rating of 25. Casement windows will meet NFRC design pressure rating of 40. Evidence of passing the following specific tests and minimum standards are required to achieve these design pressure standards.

5-15.1.1 Structural testing. Using ASTM E330 test results shall demonstrate no glass breakage, damage to hardware, or permanent deformation that would cause any malfunction or impair the operation of the unit. Residual deflection of any member shall not exceed 0.4 percent of its span. Hung windows shall be tested at pressures of 1796 Pa [37.5 lb/ft^2], and casement windows shall be tested at pressures of 2873 Pa [60.0 lb/ft^2].

5-15.1.2 Operating force. The force necessary to unlatch and open units shall not exceed 13.6 k [30 lb] for hung units and 15.9 k [35 lb] for casements.

5-15.1.3 Air infiltration. Using ASTM E283 leakage rate shall not exceed 0.65 $l/min/m^2$ [0.25 $ft^3/min/ft^2$] for hung units and 0.39 $l/min/m^2$ [0.15 $ft^3/min/ft^2$] for casements, at a test pressure of 7.66 k/m^2 [1.57 lb/ft^2].

5-15.1.4 Water penetration. Using ASTM E547, no leakage shall be evident when tested in three, five-minute cycles with a one-minute rest period between cycles at 18.3 k/m^2 [3.75 lb/ft^2] for hung units and 29.3 k/m^2 [6.0 lb/ft^2] for casements.

5-15.1.5 U-Value. Whole window U-values shall comply with Table 7-1. U-values shall be calculated using ASTM E1423 and NFRC 100-91.

5-15.2 Glazed doors. Glazed doors shall have insulated steel, vinyl clad wood, or thermally broken aluminum frames conforming to the above requirements. Finish shall be factory applied and conform to 44-C-22431 in accordance with the requirements of the National Association of Architectural Metal Manufacturers (NAAMM) Metal Finishes Manual. Operable panels shall be equipped with screens. Sliding panel screens shall have extruded aluminum tubular frames mitered at corners, channel-shaped corner angle reinforcement, and nylon bottom rollers. Doors shall have interior operated latch, and securing pin or throw-bolt in frame. Screening shall be nonferrous.

5-15.3 Glazing. Units shall be double glazed with low E-glass. The design shall consider the work involved in repair and replacement of individual panes and overall window groups.

5-15.4 Interior window stools shall be solid-wood, paint-grades with a minimum thickness of 19-mm [3/4-inch].

5-16 Screens. Screens shall be provided at all operable sashes. Screens and frames shall be aluminum, of window manufacturer's standard design, and conform to AAMA 1002.10, Voluntary Specification for Aluminum Insulating Storm Products for Windows and Sliding Doors.

5-17 Window Treatments. Provide 25 mm [1 inch] metal blinds at windows and glazed hung doors. Color shall be manufacturer's standard off white, and shall be coordinated with wall color. Drapes shall not be provided. Shades are not permitted.

5-18 Doors. See Table 7-1 for thermal performance requirements for exterior doors.

5-18.1 Entrance doors. The housing unit primary entrance door shall be 900 mm [3 ft] in width by 2050 mm [6 ft-8 inches] in height by 45 mm [1-3/4 inch] thick, thermal metal. Other housing unit entrance doors should meet this requirement but may be of lesser width. Equipment room entrance door shall be 900 mm [3 ft] in width by 2050 mm [6 ft-8 inches] in height by 45 mm [1-3/4 inch] thick, metal. **Exterior door frames shall be painted hollow metal, reinforced to accept door hardware. (AM#5)**

5-18.2 Bulk storage door. Exterior bulk storage door shall be a minimum 35 mm [1-3/8 inch] thick, exterior grade, thermal metal, or hollow core metal. **(AM#4)**.

5-18.3 Aluminum screen and storm doors. Screen and self-storing storm doors shall be provided for all housing unit exterior hinged doors. Frames shall be a minimum of 32-mm [1-1/4-inch] thick and 51 mm [2 inches] wide. Aluminum alloy materials shall be not less than 1.27-mm [0.05-inch] thick and 51 mm [2 inches] wide. Doors shall have solid bottom panels and midsection protective grills. Screening materials shall be aluminum.

5-18.4 Interior doors. Interior doors shall be 2050 mm [6 ft -8 inches] in height by 35 mm [1-3/8 inch] thick, hollow core wood or hollow panel. Wood doors will be painted. Door frames shall be paint grade solid wood construction.Pre-hung and pre-finished doors and frames may be used.

5-19 Builders Hardware. Hinges, locks, and latches will comply with the specifications indicated in Table 5-10, and the following subparagraphs:

TABLE 5-10 – HARDWARE SPECIFICATIONS

Hardware Type/ Specification	Specific Requirements

TABLE 5-10 – HARDWARE SPECIFICATIONS

Hardware Type/ Specification	Specific Requirements
Hinges ANSI/BHMA A156.1	Hinges shall be 102 mm x 102 mm [4 in x 4 in] at exterior doors, and 90 mm x 90 mm [3-1/2 in x 3-1/2 in] at interior doors. Ball bearings shall be of a base material of brass or bronze except as noted for fire rated door.
Locks & Latches ANSI/BHMA A156.2	**(AM#5) Series 4000, Grade 1, at exterior doors. Grade 2 at interior doors. Provide trim of wrought brass, aluminum, or stainless steel.**
Auxiliary Locks ANSI/BHMA A156.5	Series 4000, Grade 2. Provide matching trim of wrought brass, aluminum, or stainless steel.
Interconnected Lock & Latches ANSI/BHMA A156.12	Grade 2. Provide matching trim of wrought brass, aluminum, or stainless steel.
Closers ANSI/BHMA A156.4	Series CO2000, Grade 2.

5-19.1 Locks and keys. Lock cylinders shall have six pin tumblers and interchangeable cores that are removable by a control key. Provide a master keying system. Locks for each housing unit, including exterior storage and garage door(s), shall be keyed alike. The Contractor shall provide one extra set of cores for each 50 housing units and furnish four keys for each key change and for master key system and control key. Locks and keys shall conform to the standards and requirements of the Builders Hardware Manufacturers Association ANSI/BHMA A156.2 listed above.

5-19.2 Weatherstripping and exterior thresholds. Provide nonferrous metal or vinyl weatherstripping for all housing unit exterior doors. Vinyl magnetic weatherstripping is acceptable for metal doors. Exterior thresholds shall be nonferrous metal.

5-19.3 Applications. Locks and hinges shall be applied as follows:

5-19.3.1 Exterior hinged doors shall have 1-1/2 pair of hinges, lockset, and an auxiliary lock or interconnected lock and latch,

5-19.3.2 Each windowless entrance door will have a viewer mounted at eye level.

5-19.3.3 Exterior bulk storage door shall have 1-1/2 pair of hinges and lockset.

5-19.3.4 Interior doors shall have one pair of hinges and latchset with ANSI/BHMA A156.2, F75 or F76 operations.

5-19.3.5 Doors in fire-rated walls shall have 1-1/2 pair of steel ball-bearing hinges, lockset, auxiliary lock or interconnected lock and latch and closer. (AM#5)

5-19.3.6 Hardware Trim. Lock trim shall be cast, forged or heavy wrought construction of commercial plain design. In addition to meeting the test requirements of BHMA/ANSI A156.2 or 156.13, lever roses

and escutcheons shall be a minimum of 1.27mm (.05 inches) thick. If reinforced, the outer shell shall be a minimum of 0.89mm (.035 inches) thick and the combined thickness shall be a minimum of 1.78mm (.07 inches) except the knob/lever shanks which shall be a minimum of 1.52mm (.06 inches) thick. (AM#5)

5-20 Postal Service and Building Signage.

5-20.1 Postal Service. All new units shall be provided with an individual mailbox.

5-20.2 Building Signage. All new units shall be provided with building identification signage in accordance with the Installation Design Guide requirements.

5-20.3 Housing numbers. Provide a five-digit number for each dwelling unit. Provide a minimum 100 mm (4 inch) high house identification numbers/ letters in a Helvetica medium font colored black on a reflective white background mounted on 12-gauge aluminum for each dwelling unit. The house identification shall be mounted near each entry. The Contracting Officer will assign housing numbers.

5-20.4 Occupant Identification Signage. Provide occupant identification signage similar to existing family housing signage. Signage shall be interchangeable and made of plastic with routed letters. Total sign height shall be 50 mm (2 inch) overall including the frame. Signs shall be mounted 1500 mm (5 feet) above finish grade at side of entry. All signage should conform to the guidelines established by TRADOC sign standards (TRADOC Reg. 420-14). Names and rank shall be as directed by the Contracting Officer.

5-21 Kitchen Cabinets. Cabinets may be pre-fabricated and pre-finished or factory manufactured of wood. Wall cabinets shall have adjustable shelves. Cabinets shall have magnetic catches except where spring-loaded self-closing hinges are provided. Cabinets shall include knobs/handles and or pulls and shall conform to ANSI A161.1, Recommended Performance and Construction Standards for Kitchen and Vanity Cabinets, except where modified below. Wall and base cabinets shall be essentially of the same construction and appearance. Refer to Table 5-5 for minimum kitchen cabinet area requirements. Additional cabinet space may be achieved with tall wall cabinets.

5-21.1 Cabinets construction. Construct cabinets with frame fronts and solid ends, or of frame construction throughout. Frame members shall be mortised and tendoned, dovetailed or doweled, and glued together. Brace the top and bottom corners with hardwood blocks that are glued with water-resistant glue and nailed in place. Wood cabinet materials and dimensions - Materials and minimum dimensions and thicknesses for cabinet construction materials shall comply with Table 5-11.

TABLE 5-11 – KITCHEN CABINET SPECIFICATIONS

Element Description	Specific Requirements
Frame Members	19 mm x 38 mm [3/4 in x 1-1/2 in] kiln-dried hardwood.
Base Cabinet Toe Space	64 mm deep x 102 mm high [2-1/2 in x 4 in].
Cabinet Bottoms, Backs & Tops (Unexposed)	5 mm [3/16 in] hardwood plywood. Provide bottoms in kitchen sink cabinets. Brace bottoms with wood members glued in place.

TABLE 5-11 – KITCHEN CABINET SPECIFICATIONS

Element Description	Specific Requirements
Cabinet Ends & (Exposed Backs/Bottoms)	Hardwood plywood, 5 ply, good grade for natural finish. Base Cabinets: 13 mm [1/2 in] Wall Cabinets: 10 mm [3/8 in]
Doors	16 mm [5/8 in] hardwood plywood, good grade for natural finish, with hardwood trim. Raised panel or recessed panel.
Drawer Slides/Glides	20 gauge metal. Grade 2 ANSI/BHMA A156.7
Drawer Fronts	16 mm [5/8 in] solid hardwood, matching doors.
Drawer Bottoms	3 mm [1/8 in] softwood plywood, Grade A-B veneer. Bottoms 380 mm [15 in] wide shall be braced and glued in place.
Interior Partitions	13 mm [1/2 in] hardwood or softwood plywood, Grade A-A or comparable veneer.
Shelves	13 mm [1/2 in], softwood plywood (Grade A-B Veneer), hardwood plywood (good grade veneer), or glued-up solid wood. Support shelves on ends and on 610 mm [24 in] centers. Shelf edges exposed to view shall be rounded, filled, sanded, and finished.

5-21.2 Countertops. Countertops finish may be high pressure laminated plastic 1.1-mm [0.043-inch] thick for post-formed tops or 1.3-mm [0.05-inch] thick for countertops with separate backsplash, and shall be applied with heat-resistive adhesive. Countertops may also be ceramic tile or homogeneous, non-porous, solid surface materials. Minimum backsplash height is 100 mm [4 inches]. The substrate for countertops (except solid surface countertops) shall be 19 mm [3/4-inch] thick exterior plywood. The area behind the oven-rang and range hood shall be protected by a back splash.

5-22 Appliances. Provide the following equipment in accordance with specifications listed, one each per housing unit. A listing of currently labeled Energy Star appliances is available through the Internet at the EPA website: http://www.energystar.gov/products/appliances.html.

5-22.1 Refrigerators. Comply with UL 250, Household Refrigerators and Freezers and shall bear the EPA "Energy Star" certified label. Provide refrigerator with frostproof top freezer, automatic defrosting, and icemaker. Refrigerator shall have two vegetable bottom baskets, at least four adjustable shelves, at least two shelves and egg container in door; freezer compartment shall contain separate interior shelves, multiple door shelves, and ice maker. Provide reversible (left swing and right swing interchangeable) doors. Refrigerators shall conform to the energy compliance standards of 10 CFR 430, including those refrigerators manufactured before the code took effect. The use of refrigerants with an Ozone Depletion Potential (ODP) of .05 or less is required. Minimum refrigerator volume and maximum energy use are as follows:

5-22.1.1 Volume: 0.58 CM, 21 CF

5-22.1.2 Energy Efficiency: 722 kWh/yr.

5-22.2 Ranges and ovens. Ranges shall be 760 mm [30 inches] wide and provided with porcelain enamel cooktop, oven, clock and timer, oven light, and cooking surface light. Oven shall have black glass window door, broiler pan, and self-lock racks.

5-22.2.1 Gas ranges shall have two, 150 mm [6-inch] and two, 205 mm [8-inch] burners, a self-cleaning oven, and AGA-approved electronic ignition. Gas ranges shall be in accordance with AGA Z21.1, American National Standard for Household Cooking Gas Appliances.

5-22.2.2 Electric ranges shall have four tubular plug-in surface elements of 4,500 watts minimum, removable reflector bowls, infinite-control switches, and range-indicating lights. Ovens shall be equipped with one, 2,000-watt (minimum) tubular broil element and one, 700-watt (minimum) bake element, oven indicating light, thermostatic heat control, utensil drawer, and self-cleaning oven. Electric ranges shall conform to UL 858, Household Electric Ranges.

5-22.3 Deleted

5-22.4 Range hoods. Provide metal range hoods, the same length as the range, with a stainless steel finish, with separately switched light and exhaust fan. The hood shall have a washable filter. The fan shall have a capacity of not less than 78.7 L/s per meter of range hood [50 cubic ft per minute per linear foot of range hood]. The sound level shall not exceed 6 sones. Duct the fan to the exterior and provide backdraft protection. Range hood shall also have fire extinguishing system for range that will also shut off power or fuel to range in case of extinguishment. Acceptable device is Guardian Model as manufactured by Twenty First Century or equal.

5-22.5 Garbage disposals. Garbage disposals shall conform to UL 430; Waste Disposers; continuous feed, minimum 1/2 HP motor, stainless steel grinding elements, two 360-degree stainless steel swivel impellers, manual motor reset, and sound insulation. A plug connector is required. Garbage disposal shall be InSinkErator model 555ss, Waste King Gourmet Series model SS3100, or approved equal.

5-22.6 Dishwashers. Dishwashers shall conform to UL 749, Household Electric Dishwashers, and be UL listed, electric type, with air gap, racks, lift-out utensil holder, spraying arms, and detergent dispenser. Unit shall be listed as “Energy Star” compliant and shall bear the “Energy Star” label. The automatic controls shall cycle through the Wash, Rinse, Dry / Heat, and Stop phases, and shall be capable of rinse and hold cycle as well as a no heat drying feature. The unit shall contain instantaneous, or in-line, water heater booster, with automatic thermostat set for 60 degrees C [140 degrees F]. Rated energy use for standard capacity models will not exceed 620 kWh/yr. The dishwasher shall have factory applied sound isolating and insulating features for a sound rating no greater than 5 sones

5-22.7 Water heater. See paragraph 8- UNIT DESIGN- PLUMBING.

5-22.8 Ceiling Fans. Ceiling fans are an optional feature. Supports required for future installation are to be included. **See Chapter 9 Electrical, paragraph 9-7.2.3 for additional requirements. (AM#5)**

5-22.9 Color. Kitchen appliances, except disposals and range vent hood, shall be of matching finish, stainless steel/white/almond in color.

5-23 Maintainability. The design of housing units including the selection and specifying of exterior and interior finishes, equipment, appliances, and systems shall include consideration of maintenance ease and cost. Avoid products that require continuing maintenance at high cost. Avoid products with finishes that cannot sustain frequent and harsh scrubbing.

5-24 Fireplace and Chimney. Fireplaces and chimneys are not to be used.

6. UNIT DESIGN - STRUCTURAL.

Structural design shall comply with International Building Code and Council of American Building Officials (CABO) One and Two Family Dwelling Code, except as modified herein.

See following sheets for additional Design Criteria and 'ATTACHMENT – 6 (AM#4) SWD ARCHITECTURAL AND ENGINEERING INSTRUCTIONS MANUAL' (AEIM) for Structural Plates.

6.1 Description.

6.1.1 **General.** The structural criteria established herein shall be used for structural loading, design and installation of all structural systems and foundations, including manufacturing, erection, supervision, testing, and quality assurance of the completed installation of the housing units. All structural calculations shall be checked and initialed as such by a registered structural engineer other than the original design engineer. Refer to ATTACHMENT 7, Geotechnical Report for Foundation Design Analysis requirements and recommendations. The structural work generally consists of design, using the DESIGN LOADS and DESIGN CRITERIA below, but not limited to:

(l) Foundations.
(2) Retaining Walls.
(3) Load Bearing and Non-Load Bearing Walls
(4) Vertical Framing Members.
(5) Horizontal Framing Members, including roof decks and diaphragms, roof beams and joists.
(6) Interconnection Details including all nailing and fastening requirements.
(7) Special Conditions, such as expansion, construction, and control joints, and changes in floor levels.
(8) Attachment provisions for architectural, mechanical, and electrical elements.
(9) Site fencing structure and foundations.

6.2 References. Design methods and stress allowances or load factors for the various structural materials shall be in accordance with the current editions of the codes and specifications listed below. Recommendations made in the codes, specifications and industry standards in this paragraph are requirements of this RFP, unless specified otherwise in this RFP.

(l) American Concrete Institute (ACI 318M) Building Code Requirements for Reinforced Concrete - latest edition.

(2) American Concrete Institute (ACI 302), Guide for Concrete Floors and Slab Construction.

(3) International Building Code - latest edition.

(4) American Plywood Association, "APA Design/Construction Guide" "SDI Diaphragm Design Manual latest Edition."

(5) American Institute of Steel Construction (AISC), Manual of Steel Construction, latest edition.

(6) American Iron and Steel Institute (AISI), Cold Formed Steel Design Manual - latest Edition.

(7) American Welding Society (AWS), Structural Welding Code.

(8) National Forest Products Association, "National Design Specification for Stress Grade Lumber and its Fastening."

(9) American Plywood Association, "APA Design/Construction Guide."

(10) Truss Plate Institute, "Design Specification for Metal Plate Connected Wood Trusses."

(11) Council of American Building Officials (CABO) One and Two Family Dwelling Code – latest edition.

6.3 Selection of Structural System.

6.3.1 The overall structural system shall be selected based on durability, maintainability, and cost-effectiveness. The lateral support system shall consist of a horizontal roof diaphragm and shear walls. The horizontal roof diaphragm shall be developed with "Roof Sheathing". The shear walls shall be developed with "Structural Sheathing", "Let-in Bracing" or "Steel Strap Bracing", or a combination of Structural Sheathing and Let-in Bracing, or a combination of Structural Sheathing and Steel Strap Bracing.

6.3.2 **Foundation System.** The foundation system shall be as required by ATTACHMENT 7, Geotechnical Report.

6.4 Design Loads.

6.4.1 **Dead Loads.** The structural system shall be designed and constructed to safely support all dead loads, permanent or temporary, including but not limited to self weight, partitions, insulation, ceiling, floor covering, and all equipment that is fixed in position. Use ASCE 7-98 for weights of common building materials, or other recognized sources if not in ASCE 7-98.

6.4.2 **Vertical Live Loads.**

6.4.2.1 As a minimum, design loads shall be as stated in ASCE 7-98 (Minimum design loads for buildings and other structures) code. Design wind uplift loads shall be calculated in accordance with chapter 6 using the basic wind speed of 40 m/s (90 mph) as shown in figure 6-1, using a 3 second gust speed at 10 m (33 ft) above ground for exposure “C” category and associated with an annual probability of 0.02. A plan view of the roof shall be furnished showing all high wind edge zone dimensions and field of roof wind loads. Purlins shall be furnished a maximum of 760 mm (30 in) on center for eave, corner, rake, ridge, hip, and other edge zones and a maximum of 1520 mm (60 in) on center for the remainder of the roof (field of roof). Other criteria is as follows:

Minimum Roof Live Load - 98 K/sq.m (20 psf)

6.4.2.2 Floors shall be designed to support live loads in accordance with the ASCE 7-98 Code except:

Floor Live Load - 195 K/sq.m (40 psf)

Note: Loads may be reduced as permitted by the ASCE code.

6.4.3 **Horizontal Loads** (Acting Inward and Outward). The structural system wind design, including components and cladding shall be designed in accordance the ASCE 7-98 code, and the seismic design shall be designed in accordance with the TM 5-809-10 - latest edition. An importance factor of 1.0, an exposure category is "C", the required wind speed and Seismic Zone I are to be used.

6.5 Design Criteria.

6.5.1 **Foundation Design.** The foundation analysis and design, and minimum dimensions and reinforcement shall be in accordance with ATTACHMENT 7, Geotechnical Report.

6.5.2 **Roof Slope.** All housing units shall have pitched roofs.

6.5.3 **Serviceability.**

6.5.3.1 **Foundation Settlement Strength.** An adequate level of protection against structural failure due to uniform and/or differential foundation settlement or general shear shall be provided.

6.5.3.2 **Vertical Deflection of Suspended Horizontal Framing Members.** Building serviceability shall not be impaired by vertical deflections. The sum of the instantaneous vertical deflections due to live load plus long-term sustained load deflections shall not exceed the span divided by:

(1) 240 at roofs.

(2) 600 at masonry lintels for masonry walls.

6.5.3.3 **Horizontal Deflection.** Horizontal deflection shall not exceed the limits set forth in the International Building Code - latest edition when the structure is subjected to the required seismic or wind loads.

6.5.3.4 **Ultimate Strength of Structural Elements.** An adequate level of protection against structural failure under extreme loads shall be provided. The proposer shall check the usual loading conditions for normal factors of safety and the extreme loading conditions, if present, for appropriate (unusual) factors of safety to provide levels of protection appropriate for the conditions.

6.5.4 **Durability - Time Reliability.**

6.5.4.1 Structural components shall be protected from condensed moisture that could impair their structural adequacy through deterioration.

6.5.4.2 Special attention shall be given to protection for corrosion or oxidation of metals, decay of wood and wood base materials, spalling of concrete, leaching of mortar, and deterioration of adhesives. Prevention of these hazards shall be especially important. Nonstructural steel (handrails, etc.) embedded in concrete shall be galvanized or painted wrought iron. All damaged galvanized areas shall be repaired prior to embedment.

6.5.4.3 The materials used in structural elements, components, and assemblies shall be resistant to or protected from damage by exposure to normal climatic conditions.

6.6 General Design Criteria.

6.6.1 The design drawings shall contain General Notes which shall contain a list of the design loading criteria, a list of the strengths of the engineering materials used, the design soil values, a nailing schedule, and any other data that would be pertinent to remodeling and/or future additions.

6.6.2 Walls mostly below grade that are supported laterally by diaphragms at or near the top and bottom, shall be designed using loadings based on at-rest soil pressures.

6.6.3 Free standing earth retaining walls shall be loaded with active soil pressure and surcharge loading if present, and with this loading the vertical resultant shall be in the middle l/3 of the footing base width. For this design, factors of safety for overturning and sliding shall be at least 1.5. Retaining walls shall be constructed of reinforced concrete only. Weep holes shall be provided in the wall to eliminate saturated soil conditions behind the wall.

6.6.4 Free standing exterior garden walls shall be designed to resist lateral wind and seismic forces, for the minimum requirements set forth in this document, as per the International Building Code - latest edition.

6.6.5 Diaphragms shall have continuous chord members on all edges and shall have direct positive connection for transferring load to all members of the main lateral force resisting system.

6.6.6 Sheetrock wall covering shall not be used as a lateral resisting element of the lateral design.

6.6.7 The minimum design wind pressure on interior partitions shall be 24 KN/sqm (5psf) normal to the partition. All interior partitions shall be laterally braced.

6.6.8 Radon Mitigation: The Contractor shall design radon mitigation in accordance with **Paragraph 14, Environmental**. A 150mm minimum capillary barrier is required to encapsulate the 100mm perforated pipes of the sub-slab suction system. A polyethylene vapor barrier with a minimum thickness of 0.15mm (6 mils) will be required below the floor slab and above the capillary water barrier.

6.7 Concrete Design.

6.7.1 **General.** All concrete on this project shall have a minimum compressive strength of 21 mpa (3000 psi) at 28 days unless noted otherwise. All foundation walls and footings shall be constructed of reinforced cast-in-place concrete.

6.7.2 **Testing.** Testing of concrete work shall be done at the proposer's expense by an approved independent testing laboratory.

6.7.3 **Forms.** Materials for forms shall be plywood, metal, metal-framed, aluminum, reinforced fiberglass, or plywood-faced, to provide continuous, straight, smooth, exposed surfaces.

6.7.4 **Reinforcing Materials.** Reinforcing Bars: ASTM A 615 M-96a, minimum Grade 300, deformed.

6.7.5 **Concrete Materials.**

(1) Cement: ASTM C 150, Type I-II Portland cement low alkali (0.6% or less).
(2) Fine Aggregate: ASTM C 33.
(3) Coarse Aggregate: ASTM C 33.
(4) Air-Entraining Admixture: ASTM C 260.
(5) Flowing Concrete Admixture: ASTM C 1017, Type 1 or 2.
(6) Calcium Chloride will not be permitted.
(7) Fly Ash: ASTM C 618, Class “F”; fly ash content shall not exceed 20% of cement content or 45 kg (100 Lbs) of fly ash per .76 cu m. (Per cubic yard) of concrete, whichever is less.

6.7.6 **(AM#4)**

6.7.7 **Ready-Mix Concrete.** ASTM C 94.

6.7.8 **Slabs and Foundation Systems.** Refer to Attachment 7, Geotechnical Report for Foundation Design Analysis requirements and recommendations.

6.7.9 **Additional criteria is as follows:**

(1) Water/Cement ratio shall be less than or equal to 0.42

(2) Slump at placement shall not be greater than the design mix slump. If contractor elects to pump mix, pumping aids will be allowed, provided shrinkage potential does not increase.

(3) 7-day wet mat moist curing will be required.

(4) Reduction of cement content shall be done by using fly ash. The volume of fly ash when combined with portland cement shall be 20% plus/minus 5% of the volume of portland cement plus fly ash.

(5) High range water reducers (HRWR) will be allowed if it is shown that concrete produce with HRWR is not subject to increased shrinkage, segregation, and retarding/flash setting. Testing will by performed on concrete with the proposed HRWR to determine shrinkage potential.

(6) A mix design shall be required that incorporates a 24 mm to 38 mm (1.0 to 1.5 inches) coarse aggregate maximum with appropriate gradation specification. Follow ACI guidance for use of well graded aggregates.

(7) Use ACI 223 guidelines for the use of shrinking-compensating cements.

6.7.10 **Conduits and Pipes.** Horizontal runs of conduits and pipes will not be embedded in foundation ribs and slabs supported by ground. Vertical penetrations will conform to ACI 318-89. Aluminum conduit and pipes will not be embedded in any concrete structure.

6.7.11 **Slab Joints.** Slabs will be placed in lane fashion. Area of sections bounded by crack control joints will not exceed 54 sq. m (600 square feet), and distance between crack control joints will not exceed 7500 mm.

6.7.11.1 Slab crack control joints may be construction joints, expansion joints, or weakened plane joints consisting of plastic insert "T" strips (minimum depth shall be 1/4 depth of slab thickness) placed in the fresh concrete. Saw cut joints will not be allowed. Reinforcement will be continuous through crack control joints. Bars shall be located “t/4” below the slab surface, with a minimum of 38mm, and starting 50 mm from edge of slab. The ends of crack control and corners of isolation joints will meet at a common point so far as practical. Stop reinforcing at expansion joints and provide smooth slip dowels (minimum 13 mm diameter) across the joint. Dowels shall be ASTM A 36 material.

6.7.11.2 When thickened slabs are employed under column bases or partitions, crack control joints parallel to the thickened slabs shall be offset from the thickened areas.

6.7.11.3 Walls, when used or required for lateral resistance to wind or seismic, shall be founded on a full foundation.

6.7.11.4 Reentrant corners in slabs will be reinforced with a minimum of one No. 13x900 mm bar (metric) at 45 degrees to the corner.

6.8 Masonry Design.

6.8.1 CMU walls and partitions shall be designed in accordance with TM 5-809-3/AFM 88-3, Chapter 3 (New EI 01S903) – Structural Design For Buildings. Specify and design for type “S” mortar [Fm’ = 9300kPa (1350 psi)].

6.8.2 All masonry exterior, bearing, and shear walls (structural walls) shall be reinforced.

6.8.3 See AEIM paragraph 13, “Walls and Partitions” for additional requirements for CMU design and construction.

6.9 Structural Steel Design.

6.9.1 Detailing of structural steel framing, if any, including connections, shall be complete. All weld types, weld sizes, bolt layouts, bolt sizes, connection plates, members sizes and locations, and stiffener plates sizes and locations shall be shown.

6.9.2 All members, elements and connections that are a part of the main vertical and/or lateral force resisting system must be completely detailed.

6.9.3 Steel columns shall not be embedded over all or part of their height in CMU or concrete walls.

6.10 Cold Formed Steel Structural Framing Design.

6.10.1 Cold formed steel structural framing design shall comply with the American Iron and Steel Institute (AISI), Cold Formed Steel Design manual, Latest Edition, except as herein noted.

6.10.2 The detailing of cold formed steel structural framing, including connections, shall be complete. All welded connections, metal connectors, bolt layouts, bolt sizes, screw fastener patterns, and screw sizes shall be shown in details, notes and calculations. All members that are a part of the main vertical and/or lateral force resisting system must be completely detailed.

6.10.3 Walls, when used or required for lateral resistance to wind or seismic, shall be considered bearing walls.

6.10.4 **Structural Vertical Wall Framing.** Structural vertical load bearing, or non-load bearing wall framing shall be no less than 90 mm (3-5/8") wide, C-shaped metal studs minimum 18-gage thickness at 400 mm on center with minimum 14-gage thickness continuous runner tracks top and bottom of the walls. Vertical studs which are attached to diagonal steel tension strap bracing shall be a minimum 16-gage thickness and have three horizontal rows of equally spaced blocking (blocking shall be the same size member as the vertical studs) between the studs for the horizontal distance of the brace. Wall framing shall be attached to the foundation with minimum 9.5 mm diameter anchor bolts spaced no more than 1200 mm on center. Provide a minimum 50 mm x50 mm x 3 mm (2"x2"xl/8") washer at each anchor bolt welded to the top surface of the wall bottom runner track. All vertical studs shall be attached by welding or self-tapping screws to the wall top and bottom runner tracks. Welding shall be for the full width of both flanges of the vertical studs or there shall be at least one #12 self-tapping screw through the runner track flange to each flange of the vertical studs.

6.10.5 **Roof Trusses.** Roof trusses shall be designed for the loads indicated. The truss diagonal members shall be no less than 90 mm (3-5/8") wide, C-shaped, minimum 18-gage thickness with minimum 90 mm (3-5/8") wide, 14-gage thickness metal runner track top and bottom chords or a combination of wood combined with a metal unit which is made to adapt with the wood for the top chord outrigger for overhangs. The design of trusses shall be integrated into the vertical and lateral load carrying systems. Truss member connections shall be sized for axial loads and any eccentricity of the members. All diagonal members shall be welded to the truss top and bottom chords for the full width of both flanges of the diagonal members (self-tapping screw connection will not be allowed).

6.10.6 **Sheathing.** No particle board other than grade 2-M-W or fiberboard is to be used in structural applications, including roof sheathing and structural sheathing. The sheathing used shall have adequate and appropriate span rating" per the American Plywood Association (APA) (Design Specifications and Construction Guide) for the application and conditions proposed.

6.10.6.1 **Roof Sheathing.** Roof sheathing shall be APA STRUCTURAL I or II RATED SHEATHING, Exposure 1 or better, 15 mm (19/32-inch) minimum thickness. Joints shall be tongue and grooved or be square edges provide with H clips. All roof sheathing laid shall be covered with felt when a storm is approaching. Roof sheathing damaged due to moisture shall be replaced.

6.10.6.2 **Structural Wall Sheathing.** APA STRUCTURAL II RATED SHEATHING,
Exposure 1 or better, 12 mm (15/32-inch) minimum thickness, square edges. Solid blocking (the same size as the wall studs) shall be required at all edges.

6.10.6.3 **Structural Interior Concealed Sheathing.** APA B-D interior, grade 2 or better, 12 mm (15/32-inch) minimum thickness, square edges. Solid blocking (the same size as the wall studs) shall be required at all edges.

6.10.7 **Steel Strap Tension Bracing.** Straps shall be a minimum 14-gage thickness by a minimum 50 mm

wide. Straps shall be welded to each intersecting vertical wall stud and to the wall top and bottom runner track for the full width of the stud and runner track flange.

6.11 Structural Wood Design.

6.11.1 Wood design shall comply with the Uniform Building Code - latest edition except herein noted.

6.11.2 The detailing of structural wood framing, including connections, shall be complete. All metal connectors, bolt layouts, bolt size, nailing patterns and nail size shall be shown in details, notes and calculations. Staples shall not be used for the connections of structural components. All members that are a part of the main vertical and/or lateral force resisting system must be completely detailed.

6.11.3 Exterior wood structural members that are exposed to view such as columns and beams (minimum 100 mm nominal thickness) shall be of lumber that is graded for appearance and decay treated.

6.11.4 Walls, when used or required for lateral resistance to wind or seismic, shall be considered bearing walls.

6.11.5 **Moisture Content.** l9 percent maximum.

6.11.6 **Vertical Wall Framing** (less than 150 mm wide)**.** Studs for walls shall be stud grade lumber. Vertical (load bearing and non-load bearing) wall framing shall be no less than 2X4's at 400 mm on center with single sole and double top plates. Wood may be any species listed in the Uniform Building Code - latest edition which meets the following values:

(1) Fb (extreme fiber stress in bending):
Single Member use: 3.6 Mpa (525 psi) minimum
Repetitive member use: 4.1 Mpa (600 psi) minimum

(2) E (Modulus of elasticity) 6200 Mpa (900,000 psi) minimum

6.11.7 **Structural Framing** (Other than vertical wall framing less than 150 mm wide). Stress Grade lumber. Wood may be any species listed in the Uniform Building Code - latest edition which meets the following values:

(1) Fb (extreme fiber stress in bending):
Single Member use: 6.9 Mpa (1,000 psi) minimum
Repetitive member use: 7.9 Mpa (1,150 psi) minimum

(2) E (Modulus of elasticity): 7,580 Mpa (1,100,000 psi) minimum

6.11.8 **Boards** (less than 50 mm nominal thickness). No. 2 or better per WWPA rules.

6.11.9 **Roof Trusses.** Wood trusses shall be designed for the loads indicated and in accordance with the Truss Plate Institute, "Design Specification for Metal Plate Connected Wood Trusses". The design of trusses shall be integrated into the vertical and lateral load carrying systems. Truss connection plates shall be sized for axial loads of members, eccentricity, and net metal section. A minimum plate size of 9675 sq. mm (15 sq. In) shall be required at any respective connection. The top chord of gable end trusses shall not be notched for the installation of outriggers for a roof overhang of the end of the gable. The outriggers shall be installed on top of the gable end truss top chord.

6.11.10 **Sheathing.** No particle board other than Grade 2-M-W or fiberboard is to be used in structural applications, including roof sheathing and structural sheathing. The sheathing used shall have adequate and appropriate span ratings per the American Plywood Association (APA) (Design Specifications and Construction Guide) for the application and conditions proposed.

6.11.10.1 **Roof Sheathing.** Roof sheathing shall be APA STRUCTURAL I or II RATED SHEATHING or

Particle board Grade 2-M-W, Exposure 1 or better, 15 mm (19/32-inch) minimum thickness. Joints shall be tongue and grooved or be square edges provided with H clips. All roof sheathing laid shall be covered with felt when a storm is approaching. Roof sheathing damaged due to moisture shall be replaced.

6.11.10.2 **Structural Sheathing.** APA STRUCTURAL II RATED SHEATHING
or Particle board Grade 2-M-W, Exposure 1 or better, 12 mm (15/32-inch) minimum thickness, square edges. Solid blocking (the same size as the vertical studs) shall be required under all edges.

6.11.10.3 **Structural Interior Concealed Sheathing.** APA B-D interior, Grade 2 or Particle board Grade 2-M-W or better, 12 mm (15/32-inch) minimum thickness, square edges. Solid blocking (the same size as the vertical studs) shall be required under all edges.

6.11.11 **Let-in Tension Bracing.** Minimum 25 mm nominal thickness by 10 mm actual width "Boards" or "Simpson CWB or TWB" steel strap tension bracing or an approved equivalent (flat steel straps are not acceptable).

6.11.12 **Laminated Veneer Lumber.** Joints and beams fabricated from laminated veneer lumber may be used. Products must have National Research Board approval.

6.12 Construction Tolerances.

Allowable variations from level, or specified slopes, shall be as follows:

(1) For overall length, or surface of 3000 mm (10 ft) or less: plus or minus 3-mm (1/8-inch).

(2) Up to 6100 mm (20 ft): plus or minus 6 mm (1/4-inch)

(3) Up to 12 000 mm (40 ft): plus or minus 9 mm (3/8-inch).

7. UNIT DESIGN - THERMAL PERFORMANCE.

7-1 Thermal Characteristics. See Table 10-1 for identification of appropriate weather region. Housing unit construction shall provide at least the minimum R values / maximum U values indicated in Table 7-1 for the appropriate weather region. R and U values shall be calculated in accordance with ASHRAE methods.

TABLE 7-1 – THERMAL CHARACTERISTIC REQUIREMENTS[1, 2]

Weather Region	Wall[3] R Value	Ceiling / Roof R Value[4]	Crawl Space R Value[5]	Basement R Value[6]	Slab on Grade R Value[7]	Door R Value[8]	Glazed Openings U Value[9]	
							Window	Door
10	2.2 [13]	5.3 [30]	2.2 [13]	0.9 [5]	NR	0.9 [5]	2.9 [0.50]	2.2 [0.38]

Note[1]: Metric R values are in square meter-kelvin (K)/watt. [English R values are bracketed, and are in square foot-degrees F/BTUH]. (R = 1 / U)

Note[2]: R values listed represent the minimum acceptable insulation values for each construction type. Listed U values represent the maximum thermal conductance allowed for windows and doors.

Note[3]: Requirements for opaque, exterior walls.

Note[4]: For buildings with ventilated attics, no credit may be taken for the roof construction. R value shall be computed for construction between conditioned space and ventilated attic or building exterior. Insulation for floors which extend over outside air spaces shall conform to the ceiling and roof requirements.

If cathedral ceilings are being used, the effective R-Value of the overall roof area must meet the required “Ceiling/Roof” performance level. The effective R-Value of the overall roof area can be determined by calculating the weighted average of the R-Values of the different areas (based on the percentage of the total roof area each type covers). For example, if the Ceiling/Roof insulation required was R-38 and 25% of the ceiling was cathedral insulated to R-19, and then the required R-Value for the remaining roof would be: (38-0.25*19)/0.75=44.33, or R-45 (min).

Note[5]: Requirements for crawl space exterior walls below uninsulated floors.

Note[6]: Requirements for basement wall insulation extending downward 3050 mm [10 ft] from outside finished grade, or downward from outside finished grade to basement floor, whichever is less.

Note[7]: Slab and perimeter insulation not required.

Note[8]: Requirements for opaque doors in exterior walls (insulated metal).

Note[9]: Window requirements for double pane, low emissivity glass windows as specified in paragraph 5-15.3 of this STATEMENT OF WORK. Total Window (including glazing and frame) U values as rated by the National Fenestration Rating Council (NFRC) shall be used. Glazing area in Weather Region 10 shall be limited to 14 percent of the heated floor space. Solar Heat Gain Coefficient in Weather Region 10 shall be limited to 0.40.

7-2 Thermal Insulation.

7-2.1 Characteristics. Thermal insulation shall have a flame-spread rating of 25 or less and a smoke-development rating of 50 or less, exclusive of the vapor barrier, when tested in accordance with ASTM E84. A vapor barrier shall be provided on the warm-in-winter side of exterior wall and ceiling insulation, except in humid areas as defined below. Polyurethane is allowed as an insulation material for slabs and outside concrete or unit masonry walls. It is prohibited as an injected insulation material in walls or floor cavities or within the building envelope.

7-3 Air Infiltration.

7-3.1 To limit air infiltration buildings will be sealed with an air infiltration barrier, installed in accordance with the manufacturer's recommendations. The building envelope shall be caulked, gasketed, weatherstripped or otherwise sealed: around window and door frames, between wall cavities and frames, between walls and ceiling and roof, between walls and floors, at access doors and panels, at utility penetrations through walls, floors, and roofs, and at any other exterior envelope joint which may be a source of air leakage. These steps, in combination with provision of a continuous vapor barrier and sealed ductwork as specified in paragraph 10. shall constitute tight building construction.

7-3.2 A blower door test, performed in accordance with ASTM E 779, Measuring Air Leakage by the Pressurization Method, shall be performed on 15 percent of the project buildings, which have been randomly selected by the Contracting Officer. If buildings are to be turned over in phases, the blower door test shall be performed on 15 percent of the buildings completed in each phase (not to exceed 10 buildings per phase). No additional testing will be required if ALL of the tested buildings pass the test requirements. If less than 100 percent of the tested buildings pass the test, an additional 10 percent of the project buildings (not to exceed 10 buildings) shall be tested. This process shall continue until 100 percent of the total number of tested buildings pass the blower door test. All proto-type units will be included in the required blower door testing procedures.

7-3.2.1 Before beginning the test, all combustion devices shall be turned off, and all intentional openings in the building envelope (dryer vent, bathroom and kitchen exhausts, etc.) shall be sealed. All doors and windows shall be closed and latched.

7-3.2.2 To pass the blower door test, the building shall have an air tightness rating within the range of 3 to 4 ACH at 50 Pa [0.2 inch of water]. The Contractor shall correct all housing units not found in compliance, and shall be responsible for all labor and materials required to reduce air leakage to within acceptable parameters. All testing shall be performed by a firm certified by the Associated Air Balance Council, the National Environment Balancing Bureau, or State licensed to perform such tests within the state where the project is being constructed.

7-3.2.3 Any measures taken to reduce the air leakage to acceptable values shall be permanent, and shall be implemented on all similar housing units.

8. UNIT DESIGN - PLUMBING.

8-1 Plumbing system shall be designed and installed in accordance with the **International Plumbing Code** (IPC). Inspection and testing of the plumbing system shall be performed as prescribed in the Plumbing Code. Additional consideration in the technical evaluation will be given to systems which incorporate measures beyond the requirements of this STATEMENT OF WORK which are designed to increase energy conservation, ease of maintenance, or occupant comfort such as water filtration and purification, higher efficiency water heating systems, higher grade plumbing fixture materials (such as enameled cast iron tubs as opposed to enameled steel or plastic), etc. Plumbing systems shall be designed with consideration to the effects of expansive soils. Specific provision minimizing the detrimental impacts of expansive soil on under slab and underground piping systems shall be identified in the bidders proposals.

8-2 Water Piping. Under slab supply piping shall be limited to housing unit service entrance only. Service line to each housing unit shall be no less than 25 mm [1 inch] diameter. All water piping shall be sized in accordance with methods outlined in the International Plumbing Code, to limit water velocity in the pipe to 2440 mm/sec [8 ft/sec] unless a lower velocity is recommended by the plumbing fixture manufacturer(s). An isometric diagram of the water system shall be included in the design submittal. Allowable pipe materials are listed below:

8-2.1 Copper tubing. Water piping under concrete slabs shall be copper tubing, type K, annealed. Joints under the slabs are prohibited. All interior water supply piping shall be run above grade and shall be copper tubing, type K, L, or M hard-drawn copper. Type M copper tubing shall not be installed in exposed areas where the tubing may be exposed to external damage. Additional consideration in the technical evaluation shall be given to designs using copper types K or L. Fittings for soft copper tubing shall conform to ANSI B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes, and for hard-drawn to ANSI B16.22, Wrought Copper and Copper alloy Solder Joint Pressure Fittings.

8-2.2 Not used.

8-3 Soil, Waste, Vent, and Drain Piping. Soil, waste, vent, and drain, piping may be cast iron, copper, steel, or plastic suitable for installation in a residential waste, soil, vent, and drain system. Each fixture and piece of equipment, except water closets, requiring connection to the drainage system, shall be provided with a trap. Provide deep seal trapped drain for cooling coil condensate drain. Soil, waste, and drain piping installed below floor slabs shall be service weight hub and spigot cast iron. Building waste main lines shall be no less than 102-mm (4-inch) diameter. Building waste main line shall be provided with a two-way cleanout where the line leaves the building. All soil, waste, and drain piping shall be sized in accordance with the methods outlined in the **International (AM#3)** Plumbing Code. An isometric diagram of the sanitary sewer system shall be included in the design submittal.

8-4 Gas Connections. The use of semirigid tubing and flexible connectors for gas equipment and appliances is prohibited, except that the final connections to the kitchen ranges shall be made using flexible connectors conforming to ANSI Z21.45, Flexible Connectors of Other Than All Metal Construction for Gas Appliances, not less than 1000 mm [40 inches] long. Provide accessible gas shutoff valve and coupling for each gas equipment item. Comply with IBC or model code seismic requirements . Exposed horizontal piping shall not be installed farther than 150 mm [6 inches] from the nearest parallel wall in laundry areas or areas where clothes hanging could be attempted. See paragraph 4-5 for gas line distribution requirements.

8-5 Plumbing Fixtures. Fixtures shall be provided complete with fittings, and chromium-plated or nickel-plated brass (polished bright or satin surface) trim. All fixtures, fittings, and trim in a project shall be from the same manufacturer and shall have the same finish.

8-5.1 Plumbing shall meet the following criteria:

8-5.1.1 Exposed traps shall be chromium-plated, adjustable-bent tube, 20-gauge brass. Concealed traps may be plastic (ABS).

8-5.1.2 Faucets shall be single-control type, with seals and seats combined in one replaceable cartridge designed to be interchangeable among lavatories, bathtubs and kitchen sinks. Water flow shall be no more than .158 L/s [2.5 gpm] from any faucet. Kitchen faucets shall have extended height and shall include a retractable spray with hose.

8-5.1.3 Shower and bath combination shall be controlled by a diverter valve. Baths and shower and bath combinations shall be provided with waste fitting pop-up, concealed with all parts removable and renewable through the overflow and outlet openings in the tub. Showers and shower and bath combinations shall be equipped with a combination valve and flow control device to limit the flow to 0.158 L/s [2.5 gpm] at pressures between 137.9 to 413.7 kPa [20 and 60 psi]. Showers valves shall be pressure-balanced mixing valve with integral service stops, Symmons model 96-2 Temptrol, or approved equal.

8-5.1.4 Piping shall be concealed. Individual shutoff or stop valves shall be provided on water supply lines to all plumbing fixtures except bathtubs and showers. Shutoff valves shall be provided for each bathroom group. In multi-story units, additional consideration shall be given in the technical evaluation to designs which provide separate shutoff valves for each floor.

8-5.1.5 Fixtures shall be water conservation type, in accordance with the International Plumbing Code, and shall meet the water conservation requirements of State of Texas and City of San Antonio.

8-5.1.6 Vitreous china plumbing fixtures shall conform to ANSI A112.19.2, Vitreous China Plumbing Fixtures. Stainless steel fixtures shall be in accordance with ANSI A112.19.3, Stainless Steel Plumbing Fixtures (residential design). Plastic fixtures shall not be used. Enameled cast iron plumbing fixtures shall comply with ANSI A112.19.1. Enameled steel fixtures shall not be used.

8-5.1.7 Where tubs are installed in an end-to-end configuration in adjacent bathrooms the shower valve faucet end of the tubs shall not be back to back, but shall be located at opposite ends of the tubs to allow for maintenance and repair.

8-5.2 Water closets. Water closets shall have regular bowl with inclined tank, close coupled siphon jet, floor outlet with wax gasket, closed-front seat and cover, and an anti-siphon float valve. Water consumption shall be no more than 6 L [1.6 gal] per complete flushing cycle. Water closet trim shall conform to ANSI A112.19.5, Trim for Water-Closet Bowls, Tanks, and Urinals (Dimensional Standards).

8-5.3 Lavatories. Lavatories shall be rectangular counter top type, minimum 508 by 457 mm [20 by 18 inches] in size or oval minimum 480 by 410 mm [19 by 16 inches] in size. Lavatories shall be vitreous china or cast iron self rimming. Lavatories shall have pop-up drains.

8-5.4 Bathtubs. Bathtubs shall be slip resistant and shall be constructed of enameled cast iron, porcelain enameled formed steel, or gel-coated, glass fiber reinforced polyester resin with wainscot. Metal bathtubs shall have fiberglass or ceramic tile wainscot. Bathtub wainscot shall extend to a minimum height of 1524mm (60”) above finished floor.

Combination bathtub/shower shall have a wainscot to 1980mm (78”) above finished floor. Wainscot shall be of ceramic tile over membrane waterproofing on a cementitious substrate; or gel-coated, glass-fiber reinforced polyester.

8-5.5 Showers. Shower stalls shall be of ceramic tile, floor to ceiling, over membrane waterproofing on a cementitious substrate; or gel-coated, glass-fiber reinforced polyester. Shower receptors shall be slip resistant cast stone or slip resistant gel-coated, glass-fiber-reinforced polyester. Shower stall wainscots shall be ceramic tile or gel-coated, glass-fiber-reinforced polyester and shall extend to a minimum height of 1980mm (78”) above finished floor.

8-5.6 Kitchen sinks. Kitchen sinks shall be Type 302 stainless steel, 18-gauge minimum, seamless drawn,

and sound deadened. Sinks shall be double bowl, self-mounting without mounting rings, complete with cup strainer and plug. Bowls shall be minimum 230mm (9 inches) deep. Food waste disposers shall be in accordance with UL 430 and ASSE 1008, and shall have a minimum motor size of 370 watts [½ horse power]. Strainer shall be eliminated where food waste disposers are provided.

8-6 Clothes Washer Connections. Drainage and hot and cold water supply shall be provided for automatic clothes washers. Washer connection, complete with 50-mm [2-inch] drain, 20-mm [3/4-inch] hose thread supplies shall be provided in standard manufactured recessed wall box with single-face plate. Boxes shall be constructed of plastic or sheet steel. Steel boxes shall have a corrosion-resistant epoxy enamel finish. Boxes shall be mounted a minimum of 865 mm [2 ft-10 inches] above the finish floor. Electrical outlets for both washer and dryer shall also be provided.

8-7 Refrigerator Ice Maker Connection. Cold water supply shall be provided for GF refrigerator ice makers. Ice maker connection shall include an angle valve and a 1/4 inch hose thread supply, and shall be provided in standard manufactured recessed wall box with single-face plate (plastic or steel). Boxes shall be mounted a minimum 2 ft-10 inches above the finish floor.

8-8 Hose Bibbs. Hose bibbs shall be provided at one side and at the rear of each building for each ground level housing unit. Hose bibbs shall be supplied with an integral vacuum breaker. Valve body shall be all brass. Valve handle shall be metal. Valve seats, washers, and stem packing shall be fully serviceable without removal of the valve body. Vacuum breaker shall be brass and shall not have any exposed plastic.

8-9 Piping Location. Water piping running in crawl spaces and attics shall be installed on the warm side of insulation and shall be wrapped with insulation and a vapor barrier jacket. Determination of the warm side shall be the same as determined for vapor barrier location. No water piping runs in exterior walls shall be allowed, except in climates where the 99 percent dry bulb temperature is 1.7 degrees C [35 degrees F] or higher.

8-10 Cleanouts. Cleanouts shall be provided at each change in direction of sanitary sewer lines, at the intervals specified in the National Standard Plumbing Code, and at the building service entrance. All cleanouts shall be permanently accessible. Ground cleanouts shall be two-way type, installed in a 305-mm by 305-mm [12-inch by 12-inch] concrete pad, flush with grade.

8-11 Water Heater. Water heaters shall have round, glass lined tanks, and shall have factory applied insulation having a minimum metric R value of 2.8 (in-lb R = 16). Access shall be provided through the insulation for service and maintenance openings. Storage water heaters that are not equipped with integral heat traps and having vertical pipe risers shall be installed with heat traps directly on both the inlet and outlet. Circulating systems need not have heat traps installed. The water heater temperature and pressure relief valve shall be installed in accordance with code. Water heaters shall be sized in accordance with Table 8-1 for a 32 degrees C [90 degrees F] rise. Water heater energy factors shall meet or exceed the minimum requirements of 10 CFR 430. Additional consideration in the technical evaluation will be given to designs which include water heaters which exceed the minimum energy efficiency requirements and which utilize high efficiency, power vented, or sealed combustion water heaters.

TABLE 8-1 - WATER HEATER SIZING

Requirements by Fuel Type	2 BR	3 BR	4 BR		5 BR	
	1 Bath	2 Bath	2 Bath	3 Bath	2 Bath	3 Bath
Gas & Oil:						
Storage (L [gal])	114 [30]	151 [40]	151 [40]	194 [50]	194 [50]	194 [50]
1 hour draw (L [gal])	227 [60]	265 [70]	273 [72]	310 [82]	341 [90]	341 [90]
Recovery (L/h [gph])	114 [30]	114 [30]	121 [32]	121 [32]	151 [40]	151 [40]

TABLE 8-1 - WATER HEATER SIZING

Requirements by Fuel Type	2 BR	3 BR	4 BR		5 BR	
	1 Bath	2 Bath	2 Bath	3 Bath	2 Bath	3 Bath
Electric:						
Storage (L [gal])	114 [30]	189[50]	189[50]	250 [66]	250 [66]	250 [66]
1 hour draw (L [gal])	167 [44]	273 [72]	273 [72]	333 [88]	333 [88]	333 [88]
Recovery (L/h [gph])	53 [14]	83 [22]	83 [22]	83 [22]	83 [22]	83 [22]

Note: Storage capacity, input, and recovery may vary with manufacturer. Any combination of the above which produces the required hour draw will be acceptable.

8-11.1 Gas fired water heaters shall be in accordance with ANSI Z21.10.1, Water Heaters, Gas, Volume I, Storage Type, 22 kW [75,000 BTUH] Input or less, and shall be high efficiency type. Water heaters with powered ventilation shall be vented in accordance with manufacturer's instructions. Additionally, natural gas-fired heating equipment with a max rated input capacity of 586 kw (2.0 MMBtuh) or less shall be in compliance with Nitrogen Oxide limits as specified in 30 Texas administrative Code, part 1, Chapter 117, Subchapter D, Division 1, Rule 117.465. Gas fired water heaters shall have annual energy use of 246 therms or less based on 10 CFR 430, Subpart B, Appendix E.

8-11.2 Water heaters shall be installed in the mechanical equipment room at floor level. Adequate space shall be available for required clearances as well as proper servicing and removal and replacement without disassembly of any other equipment in the room.

8-11.3 **BID OPTION 1** Electric water heaters shall comply with UL 174, Water Heaters, Household Electric Storage Tank Type, and shall have an Annual Energy Use (kWh) of 4,773 or less based on DOE test procedure 10 CFR430, Sub-Part B, Appendix E. Water heaters shall be connected to the ground coupled heat pump desuperheater.

8-12 Fire Protection. Provide a wet chemical fire extinguishing unit for each kitchen range, mounted in cabinet above or beside the kitchen range exhaust hood. System shall be a minimum 2 ½ lb capacity, stored pressure type with automatic detection of fire and release of extinguishing agent through fixed nozzles. System shall provide pressure actuated shutoff of range energy source (either gas or electric) and shall include an audible discharge alarm. System shall be UL listed "Residential Range Top Extinguisher Unit". System shall be "The Guardian" as manufactured by Twenty First Century International Fire Equipment and Services Corporation of Irving, Texas, or approved equal.

9. UNIT DESIGN - ELECTRICAL.

9-1 Conformance to Code. The electrical system shall be designed in compliance with the rules and recommendations of ANSI C2, National Electrical Safety Code; NFPA 70, National Electrical Code (NEC); **(AM#4)** and applicable model codes, whichever is more stringent. Provide main circuit breaker in the main panel for each dwelling unit, sized in accordance with the NEC.

9-2 Service Entrance. Service entrances, exterior meters, and panels shall be enclosed or sight screened. Service feeders shall be underground with exterior meters. Panel boards shall be dead front, painted galvanized steel, and furnished with main breakers. Panel board doors shall be flush one-piece fronts. Panel boards may be surface or recessed mounted depending on their location. In hallways, panel boards shall be recessed. Back-to-back panel boards shall be offset a minimum of 400 mm [16 inches] horizontally. Tandem circuit breakers shall not be used. Printed labels, in the panel board, shall be provided for all installed circuits. Recessed panel boards are not to be located in party walls and fire walls.

9-3 Panel Board Locations. Each dwelling unit shall have it's own distribution panel board. Panel boards shall be located in the utility/laundry room, or hallway.

9-4 Conductors. Conductors shall be copper and not smaller than #14 AWG.

9-5 Outlet Circuits. All general receptacle and lighting circuits shall be 15 Ampere circuits, fed by 15 Ampere circuit breakers unless noted otherwise. Receptacles on opposite sides of common walls shall be horizontally offset a minimum of 300 mm (12 inches) to maintain the integrity of the fire wall and sound deadening rating of the wall.

9-5.1 Separate Circuits. Lighting and receptacles shall be on separate branch circuits. Where half-switched receptacles are installed for auxiliary cord-connected lighting, the entire receptacle shall be fed from the same circuit. Such circuits may be either lighting or receptacle circuits.

9-5.2 Outlets Per Circuit. Circuits for lighting or general purpose receptacles shall be limited to a maximum of six (6) current consuming outlets. This requirement shall supersede any others.

9-5.3 Outlet grounding. All equipment, appliances, lighting fixtures, and receptacles shall be grounded by an equipment grounding conductor which shall be terminated at a grounding screw in the outlet box. A grounding jumper shall connect the equipment, fixture, or receptacle to this grounding screw.

9-6 Exterior Lighting. Provide energy efficient high quality lighting for each housing unit. The minimum efficiency standard for lighting is 50 lumens/watt. This efficiency can be achieved with fluorescent and compact fluorescent lighting. Lighting must also be color corrected with a Color Rendering Index (CRI) of 60 or better. Provide a minimum of one lighting fixture in each dwelling unit's entry, carport, and patio or balcony area(s). Light fixtures at entry and patio or balcony areas shall be switched from the dwelling unit interior. Provide a fixture in the patio area, except that the patio area light shall not be provided where the patio is adjacent to an exterior entrance and is adequately served by the lighting fixture required herein before.

9-7 Interior Lighting and Switched Outlets.

9-7.1 Efficiency. Interior lighting will be both efficient and color corrected. Color Rendering Index (CRI) of 85 or better and a standard lighting color of 3500 K are required. Incandescent fixtures are not allowed. Minimum efficiency standard for lighting are as follows:

9-7.1.1 Fluorescent tubes 1220 mm [4 ft] and longer: 90 lumens/watt.

9-7.1.2 Fluorescent tubes less than 1220 mm [4 ft]: 80 lumens/watt.

9-7.1.3 Compact fluorescent and other lamps: 50 lumens/watt.

9-7.2 Locations. Provide light fixtures operated by wall switches for all rooms except living rooms. Living room shall have a convenience duplex receptacle, half controlled by a wall switch, located at the room entrance. Wall-switch operated ceiling lights shall be provided in dining and utility rooms, halls, bedrooms, kitchens, and dinette areas. Additional light fixtures shall be provided in rooms whose configuration requires them for adequate lighting. Wall-switch operated wall-mounted lights shall be provided in bathrooms and half baths located above the mirror over the lavatory. Walk-in closets and interior and exterior bulk storage rooms shall be provided with ceiling lights, either wall switch or pull-chain operated. A minimum of one lighting fixture, ceiling or wall mounted, as appropriate, shall be provided in the carport.

9-7.2.1 Dining room ceiling light fixtures (hanging type) shall be movable by means of a track, chain and hooks, or other means in order to accommodate other than the typical dining room furniture arrangement. Fixtures may be designed for incandescent use, and do not have to meet the 50 lumens/watt requirement. A ceiling fan with integral lighting fixture may be substituted for this requirement.

9-7.2.2 The general lighting intensity in kitchens shall be 320 to 540 Lx [30 to 50 foot-candles]. Supplementary lighting shall be provided at the sink and under one of the wall cabinets for a work center to produce a composite lighting level of 810 Lx [75 foot-candles] using either down-lights, surface-mounted fluorescent fixtures below wall cabinets or wall-mounted fixtures (1520 mm [5 ft] and higher above the floor) as appropriate. Kitchen range hood shall be provided with a light, fan, and switches.

9-7.2.3 The ceiling mounted light fixtures in the living room, family room (if provided), dining room, and all bedrooms shall be provided with a metallic fixture box suitably supported from the ceiling structure so that it may support a ceiling fan. Additional wiring and a switch shall also be provided next to light switch to allow for independent wall switch control of the fan and light.

9-8 Smoke Detectors. A household fire warning system, per NFPA 70, National Electrical Code; NFPA 72, National Fire Alarm Code; and NFPA 101, Life Safety Code, shall be installed in each unit. Hard-wired smoke detectors shall be located and installed on the ceilings of each dwelling unit in accordance with the requirements of NFPA 70, 72, 101, and UL 217. Each sleeping room shall have a separate smoke detector. All smoke detectors shall be of the photoelectric type. All smoke detectors shall have audible annunciation using the temporal 3 pattern. Smoke detectors in handicapped adaptable units shall also have visual annunciation with a 177 Candela rating. The mounting bases shall be permanently wired and supplied by a dedicated circuit. Circuit breaker for smoke detector circuit shall be clearly labeled and provided with a warning for occupants not to shut off. All smoke detectors within a living unit shall be interconnected so that operation of any smoke detector shall cause the alarm audio and visual devices in all smoke detectors in that unit to activate. All smoke detectors shall be interconnected with battery backup. Smoke detectors shall not be located near air exchange vents. Additional consideration in the technical evaluation will be given to designs that provide smoke detectors with pull out trays for changing batteries. This type of smoke detector allows the occupant to change the battery without having to remove the detector from its mounting. Activation of a smoke alarm shall not cause activation of a carbon monoxide alarm.

9-9 Carbon Monoxide Alarms. Provide carbon monoxide (CO) alarms equipped with a fuel burning appliance inside of the dwelling unit. Activation of a CO alarm shall not cause activation of a smoke alarm. CO alarms will be provided as follows:

9-9.1 One CO alarm shall be located on each level of the dwelling unit. A required alarm shall be located in vicinity of the bedrooms, such as in the corridor outside of the bedrooms. CO alarms will not be provided in furnace rooms or unfinished attics.

9-9.2 CO alarms shall be hard-wired and wall-mounted at the same height as the thermostat, approximately 1.3 m [52 inches] off the floor. Dead air spaces such as corners shall be avoided. Units may be powered from circuits powering smoke detectors. In all cases, manufacturer's guidelines and recommendations shall be followed.

9-9.3 CO alarms shall be equipped with an audible alarm, continuous digital display, peak level memory, test button, and test reset button and shall be UL listed by passing standard test UL 2034.

9-10 Telephone. Provide dual jack outlets in family room (if provided), living room, and each bedroom of each dwelling unit. Provide a single jack outlet in the kitchen. Eight position modular jack connectors shall be provided. The jack provided in the kitchen shall be for a wall-mounted phone. Wiring methods shall comply with EIA/TIA Standard 570, Residential and Light Commercial Telecommunications Wiring Standard. Cable and jacks shall be Category 5e per TIA/EIA 568A, Commercial Building Telecommunications Cabling Standard. Cable shall be unshielded twisted pair (UTP), #24 AWG, solid copper station. Each dwelling unit shall be pre-wired separately from other dwelling units in the same building. All wiring shall terminate in a surface mounted, weatherproof, protected telephone terminal ("Demarcation Box") located on an outside wall adjacent to the building electric metering equipment. Each dwelling unit shall have a protected telephone terminal. The protected telephone terminal cover shall be provided with means for padlocking, shall be accessible from the outside, and shall be permanently labeled, "Telephone". Gas protected telephone terminals shall be provided for all incoming phone lines. A single #10, CU, green equipment grounding conductor shall be run in 16 mm (1/2-inch) non-metallic conduit from the electric metering equipment to the protected telephone terminal box. Home run style wiring shall be utilized between each jack and the protected telephone terminal. 4-pair cable shall be home run from each outlet except 2-pair cable may be used for kitchen outlet. No circuits shall be routed on the interior or exterior surfaces of dwelling units, or on the surfaces of walls in other structures. Outlet boxes shall be 117 mm (4-11/16 inches) square by 53 mm (2-1/8 inches) deep. Sizes of protected telephone terminals shall be coordinated with local Telephone Company.

9-11 Commercial Cable Television. Cable Television (CATV) outlets shall be located in the kitchen, living room, family room (if provided), and bedrooms. A minimum of two outlets shall be provided in the living room to allow flexibility in furniture layout. Outlets shall be located next to telephone jacks (kitchen excluded) to allow connection of a satellite receiver. Each dwelling unit shall be pre-wired in conformance with all local CATV company requirements. Each dwelling unit shall be pre-wired separately from other dwelling units in the same building. All wiring shall terminate on an 8-output coupler located inside a surface mounted, weatherproof, protected television terminal ("Demarcation Box") located on an outside wall adjacent to the protected telephone terminal. Each dwelling unit shall have a protected television terminal. The protected television terminal cover shall be provided with means for padlocking, shall be accessible from outside and shall be permanently labeled "Television". A single #10, CU, green equipment grounding conductor shall be run in 16 mm (1/2-inch) non-metallic conduit from the electric metering equipment to the protected television terminal box. Home run style wiring shall be utilized between each jack and the protected television terminal. Cable shall be RG-6 with minimum coverage of 67%. Type of tap offs, and sizes of protected television terminals and outlet boxes shall be coordinated with local cable TV Company. Local TV Company is Time Warner and the POC is Mr. Peter Perez at 210-352-4466. E-mail address is peter.perez@twcable.com.

9-11.1 Satellite Television. Provide two home run coax cables (one set per dwelling unit) from protected television terminal to exterior mounted satellite dish bracket (as described in architectural section 5). Cables shall be type RG-6 with minimum coverage of 67% and shall be completely concealed except for the length between where the cables exit the house and the bracket. This exposed length shall be minimized to the largest extent possible, but sufficient slack shall be provided to allow easy connection to an occupant installed dish. Sufficient slack shall also be provided within the protected television terminal to allow connection to any of the 8-output coupler’s jacks. Type F male connectors shall be provided on the ends of both cables.

9-12 Doorbell. The front entrance to each dwelling unit shall be provided with a low voltage bell or buzzer. Doorbell shall be hard-wired. Handicapped adaptable dwelling units shall also be provided with hook up provisions for future installed wall-mounted strobe visual annunciators in the entry hallway and kitchen.

9-13 Convenience Receptacles. In addition to receptacles required by NEC, provide convenience receptacles in the following areas:

9-13.1 Equipment room

9-13.2 Hallway outside bedrooms

9-14 Special Receptacles. Provide 240 V electric receptacles for electric dryer (this is in addition to the 120 V receptacle required for a gas dryer) and electric range. Provide a switched 120 V receptacle under kitchen sink for garbage disposal.

9-15 Wiring. Maximum use shall be made of nonmetallic-sheathed cable for branch circuit wiring, and of service entrance cable for heavy-duty interior circuits and for service entrance conductors. Installed conductors in conduit shall be used only where specifically required by the NEC except that all exposed electrical wiring shall be put in steel metal conduit and receptacle boxes.

9-16 Branch Circuit Conductors. Branch circuit conductors and over current devices shall be as rated by NEC. A minimum of one spare circuit space in the panel shall be provided per dwelling unit. Individual circuits shall be provided for the clothes washer, clothes dryer (with receptacles located behind the washer and dryer), dishwasher, garbage disposal, freezer, electric range, furnace or air handling unit, air conditioning unit, and water heater. Two utility circuits (20 amp utilizing #12 AWG wire) shall be provided in the kitchen area for the convenience outlets for small appliances serving the kitchen, dining area, and family room area. The furnace or air handling unit and the air conditioning unit shall be provided disconnect switches in addition to the branch circuit breaker.

9-17 Exterior Receptacles.

9-17.1 One duplex receptacle shall be provided in each dwelling unit’s entry, carport, and patio or balcony area(s).

9-17.2 One duplex receptacle, fed and switched with the front entrance door light, shall be provided for holiday lighting. This is in addition to the one required by paragraph 9-17.1.

9-17.3 Receptacles shall have weatherproof “Taymac” type covers that are rated NEMA 3R with a plug cord attached.

9-18 Ground Fault Protected Receptacles. All receptacles that are required to have ground fault protection shall be fed by a ground fault interrupting circuit breaker except that the dedicated receptacle in the bathroom shall itself be the ground fault interrupting type.

10. UNIT DESIGN - HEATING, VENTILATING, AND AIR CONDITIONING.

10-1 Design. Heat gain and loss calculations shall be, as a minimum, in accordance with the current edition of the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Handbook of Fundamentals or ACCA Manual J. The cooling load calculations shall be in accordance with ASHRAE Residential Cooling Load Calculations. Computer-generated load calculations shall be provided, and shall include complete input and output summaries. Design shall be based on the weather data shown in Table 10-1 and Table 10-2. HVAC system shall be designed to minimize noise transmitted to the habitable space. The design noise criteria (NC) shall be no greater than 40 in any habitable space.

TABLE 10-1 – WEATHER DATA[1]

Type of Design / Design Information	Metric	Inch-pound
Weather Region	10	
Heating[2]		
Indoor Design Temperature	21 ^{o}C	70 ^{o}F
Outdoor Design Temperature	-1 ^{o}C	30 ^{o}F
Annual Heating Degree[3] Days	870	1570
Largest Number of Monthly Heating Degree Days[3]	278	500
Cooling		
Indoor Design Temperature	24 ^{o}C	75 ^{o}F
Outdoor Design Dry Bulb Temperature	36 ^{o}C	97 ^{o}F
Outdoor Design Wet Bulb Temperature	24.5 ^{o}C	76 ^{o}F

Note[1]: From TM 5-785, Engineering Weather Data.
Note[2]: Bin weather data is available from TM 5-785, Engineering Weather Data.
Note[3]: Metric data are based on Celsius degree days to a base of 18 degrees C. Inch-pound data are based on degree days Fahrenheit to a base of 65 degrees F.

TABLE 10-2

BIN WEATHER DATA FOR FORT SAM HOUSTON, TEXAS	
TEMPERATURE RANGE, C (F)	ANNUAL OBSERVATION, HRS
40/43 (105/109)	0
38/40 (100/104)	20
35/38 (95/99)	195
32/35 (90/94)	423
30/32 (85/89)	593
27/30 (80/84)	847
24/27 (75/79)	1375
21/24 (70/74)	1121
18/21 (65/69)	918
16/18 (60/64)	760
13/16 (55/59)	636
10/13 (50/54)	594
7/10 (45/49)	481
4/7 (40/44)	371
2/4 (35/39)	237
-1/2 (30/34)	121
-4/-1 (25/29)	46
-7/-4 (20/24)	12
-9/-7 (15/19)	2
-12/-9 (10/14)	1
-15/-12 (5/9)	0

NOTE: Data from TM 5-785, Engineering Weather Data

10-1.1 Load calculations. Computer generated load calculations shall be performed for each possible orientation up to four representative orientations for each building type included in the project. Room air flow requirements shall be computed based on the individual room load. However, the minimum acceptable air flow

shall be 2.5 (L/s)/m^2 [0.5 cfm/ft^2] for all spaces. The design for each individual housing unit shall be based on the heating and cooling loads as well as room airflow requirements computed for the building type and orientation which it most closely matches. Internal loads shall be included in the computerized load calculations in accordance with ASHRAE recommendations for residential analyses.

10-1.2 Duct system layout. For a given building type, a single duct layout may be used regardless of orientation, provided that the system is sized to provide the required air flow for each room at its worst case orientation. Balancing dampers shall then be used to reduce air flow to the appropriate level as required. Permanent access to dampers shall be provided.

10-2 Equipment Safety and Efficiency. All materials and equipment shall be the standard cataloged product of manufacturer's regularly engaged in production of such materials and equipment, and shall be the manufacturer's latest standard design. Each major component of the heating [and cooling] system[s] shall have the manufacturer's information on a plate secured to the equipment.

10-2.1 All heating and cooling equipment proposed and installed in this contract shall bear the Energy Star Label.

10-2.2 Equipment shall comply with the requirements of American Gas Association (AGA), American National Standards Institute (ANSI), Air Conditioning and Refrigeration Institute (ARI), American Society for Testing and Materials (ASTM), Gas Appliance Manufacturers Association (GAMA), National Electric Manufacturers Association (NEMA), National Fire Protection Association (NFPA), Underwriters Laboratories, Inc. (UL) or other national trade associations as applicable.

10-2.3 Equipment efficiencies as listed in Table 10-3 below are minimum acceptable levels. Energy conservation as it relates to equipment operating costs will be considered in the evaluation process. Additional consideration in the technical evaluation will be given to designs which include higher than minimum efficiency equipment.

TABLE 10-3 - MINIMUM EQUIPMENT EFFICIENCIES

	Natural gas fired equip	Electric heat pump (ground coupled)	Electric cooling only split DX cond. Unit and matched coil
Furnace AFUE	90%[1]		
Heating Mode COP		4	
Cooling EER[2]		12.7	10
SEER[3]		15	12.7

Note[1]: Efficiency is based on DOE test procedure 10CFR430, Sub-Part B, Appendix N.

Note[2]: EER measured in accordance with ARI 210/240 at rating conditions.

Note[3]: Efficiency is based on DOE test procedure 10CFR430, Sub-Part B, Appendix M.

10-3 Heating and Cooling Systems. Each housing unit shall be provided with central heating and air conditioning system[s]. Systems shall be designed, installed, balanced, and adjusted to distribute heat and cooling to all habitable rooms, as well as bathrooms, in proportion to the calculated load requirements of these spaces. Fans in air handlers and furnaces shall be multi-speed, direct drive type. Fans in air handlers and furnaces shall not be variable-speed type. System installation shall conform to SMACNA Installation Standards for Residential Heating and Air Conditioning Systems except as altered by this document. Additional

consideration in the technical evaluation will be given to systems utilizing modular components, plugged power, stainless steel heat exchangers, drawer-type burner assemblies, additional space in the mechanical room, and other features which contribute to ease of system maintenance. Additional consideration will also be given to designs which provide measures beyond the requirements of this STATEMENT OF WORK to increase energy conservation or occupant comfort such as division of each housing unit into more than one conditioning zone for increased control.

10-3.1 Equipment sizes selected for installation shall not be oversized more than 125 percent of the calculated loads (exception, gas fired furnace heating capacity may exceed 125 percent of the calculated heating load in order to match air handler selection with required cooling loads).

10-3.2 Mechanical space shall be provided to house all mechanical equipment. Exterior air conditioning units shall be concrete pad-mounted, with location selected based on site specific conditions and intended uses of outdoor space. Effort shall be made to locate the unit(s) out of the occupant's direct line of sight (screen with shrubbery or wall, locate on sides of housing unit, avoid placement under windows, etc.). However, the primary concern shall be coordination with the mechanical area location. Mechanical equipment shall be located in an externally accessible equipment room, and shall be arranged to allow for ease of maintenance, and for proper venting if required. This equipment room shall be provided with a light and electrical receptacle. The mechanical equipment room shall be a part of the dwelling structure. The mechanical equipment room shall be provided with a floor drain to accept condensate. The mechanical equipment room shall have a depressed floor to prevent condensate or leakage from entering the dwelling. The mechanical equipment room shall have a concrete pad outside the access door. Mechanical equipment shall not be located in attic spaces. A desirable feature is to locate the mechanical equipment access on the side of the dwelling or otherwise accessible without traversing areas that may be fenced. See paragraph 5-6.3 for additional requirements for mechanical spaces containing fuel-fired heating equipment.

10-3.3 Forced warm air systems. Warm air furnaces shall be induced combustion, upflow, high efficiency, natural gas furnaces. Furnaces shall be equipped with electronic ignition. High efficiency (AFUE > 90 percent) gas furnaces shall be vented in accordance with AGA requirements and the manufacturer's instructions. Condensate drains for high efficiency units shall be manufacturer approved, and shall be indirectly connected to the building sanitary sewer system. Combustion air shall be provided from the outside in accordance with the appliance listing. Furnaces shall be equipped with centrifugal fan, disposable filters, controls, and transformer. Fans shall be multi-speed, direct-drive type. It shall be possible to service and replace all controls and internal components from one side of the furnace. Heat exchangers shall be guaranteed for a minimum service life of 10 years. Furnaces shall be equipped with a cooling coil by the same manufacturer, matched to the selected air conditioning equipment.

10-3.4 Not used.

10-3.5 Split system air conditioning:

10-3.5.1 Electric air conditioning equipment shall consist of an air-cooled condensing unit and evaporator as matched components with the furnace, all by the same manufacturer. Refrigerants used shall have an Ozone Depletion Potential (ODP) of .05 or less. The condensing unit shall contain, as a minimum, the features indicated in Table 10-4. Equipment shall be sized to meet the total load determined by computer calculation. Equipment may be oversized to no more than 125 percent of the computer generated load. Fans shall be multi-speed, direct drive type.

TABLE 10-4 – SPLIT SYSTEM AIR CONDITIONING & HEAT PUMP FEATURES

High and low pressure compressor protection.
Filter-drier.
Hermetically sealed compressor with built-in overloads and locked rotor protection.

TABLE 10-4 – SPLIT SYSTEM AIR CONDITIONING & HEAT PUMP FEATURES

Electric crankcase heaters.
Start and run capacitors.
Anti-short-cycle timer. (factory installed)
Testing and charging refrigerant connections.
Compressor guaranteed for a minimum service life of 5 years.
Fan and coil guards.

10-3.5.2 The evaporator coil shall be provided with a liquid strainer, expansion device, pre-insulated housing, copper or aluminum coil, and insulated condensate drain pan. Coil face velocity shall be limited to 2.8 m/s [550 fpm].

10-3.5.3 The condensing unit and matched coil shall deliver a Seasonal Energy Efficiency Rating (SEER), consistent with the minimum requirements shown in Table 10-3.

10-3.5.4 Not used.

10-3.5.5 Refrigerant Charge Verification: When split-system air conditioning systems are selected for installation, the contractor shall check, calibrate, and charge the refrigerant system following installation and start-up of the equipment. These tests shall be accomplished on the same 15% of the units which undergo blower door and duct tightness testing. If the tested units show a low or excessive refrigerant charge, all new systems shall be checked after start-up, but prior to acceptance by the Government.

10-3.6 **Bid Option 1** Ground Coupled Heat Pumps: In lieu of gas fired warm air furnace, split system electric cooling, and gas fired water heater, Bid Option 1 shall provide ground coupled heat pump for heating and cooling and electric water heater coupled to a desuperheater for water heating.

10-3.6.1 One ground-coupled heat pump shall be provided for each living unit. Units shall be rated in accordance with ARI 330 GSHP (Closed Loop). Units shall have a head loss of not more than 36 kPa (12 feet of water) at the flow rate used to obtain the ARI 330 rating. Units shall have extended range capability to include entering liquid temperature down to 0 degrees C (32 degrees F) in heating and up to 38 degrees C (100 degrees F) in cooling. Units shall be located in the externally accessed utility room adjacent or close to the domestic water heater. A desuperheater shall be provided to use the Ground-Coupled Heat Pump as a heat source for domestic hot water during the cooling season. A 10 kilowatt (minimum) emergency backup electric resistance duct heater shall be incorporated into the system design for each unit.

10-3.6.2 The loop piping shall be PE3408 (high density polyethylene) with minimum cell classification 355434C per ASTM D 3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials. The piping shall experience 0 failures after 5,000 hours under condition “C” (2100 percent reagent at 100 degrees C) when tested in accordance with ASTM D 1693, Standard test method for environmental Stress-Cracking of Ethylene Plastics. A 50 year limited warranty must be issued by the pipe manufacturer. U-type fittings shall be shop fabricated under quality controlled conditions of the same material designation. Joining shall be by the butt fusion or saddle (sidewall) fusion method in accordance with the manufacturer’s Heat Fusion Qualification Guide. Ground loops shall be installed by a certified installer, trained by the International Ground Source Heat Pump Association or factory trained by the ground coupled heat pump manufacturer. A certified fusion technician will perform all pipe fusions. Bore shall be vertical with a minimum 6 meter (20 feet) separation. Bores shall be fully backfilled with thermally enhanced grouts (Bentonite-Quartzite mixture).

10-3.6.3 Design of closed-loop ground source heat pump shall conform to ASHRAE publication, Design/Data Manual for Closed-Loop Ground-Coupled Heat Pump Systems. Accurate calculations supporting the units selected, sizing of pumping modules, bore pipe sizing and bore depth shall be provided. Based on ore data at the site, the bore **depth (AM#2)** is expected to be a minimum of 29.5 meters per kW (340 ft per ton) of cooling at the site. The Contractor shall verify bore **depths (AM#2)** by performing a soil thermal conductivity test at the site. Total bore length per ground coupled heat pump unit shall be as determined by applying the calculated length per ton to the installed nominal tonnage per unit and not the calculated unit design load.

10-3.6.4 Contractor shall use mandatory specification section 15741 Vertical Ground-Coupled Heat Exchanger System (VGCHES).

10-3.7 Not used.

10-3.8 Not used.

10-3.9 Not used.

10-3.10 Unacceptable systems. Room unit heaters, space heaters, room (window) air conditioning units, floor furnaces, gravity warm air systems, and electric resistance heaters are not permitted.

10-4 Air Distribution. Provide systems conforming to the recommendations of the ASHRAE Air Distribution Manual or the SMACNA Residential Comfort System Installation Standards Manual. For two-floor housing units with a single air conditioning unit, provide separate, main supply ducts with volume control dampers for each floor. These main ducts shall be run directly from the air handler or furnace to the appropriate building level. As a minimum, provide a separate ducted return for each floor level. Two-floor housing units with 93 m^2 [1,000 ft^2] or greater net floor area on each floor shall be provided with a separate heating and cooling unit and supply and return ducted system for each floor. Additional consideration in the technical evaluation will be given to designs which incorporate air distribution systems totally within the conditioned envelope.

10-4.1 Supply diffusers. Wall, ceiling, and/or baseboard supply diffusers shall be located to ensure that the air distribution will completely cover all surfaces of exterior walls with a blanket of conditioned air. At least one diffuser shall be provided in each habitable room. Diffusers shall have louvered faces with individually adjustable blades, and shall be provided with integral opposed blade damper. Diffusers shall be provided with air deflectors as required for proper air flow in the space. Plastic diffusers are prohibited. Core velocity shall be limited to 3 m/sec [600 fpm] maximum, with a maximum pressure drop of 0.82 Pa/m [0.1 inch water]. Airflow from any single diffuser shall be limited to 94.4 L/s [200 cfm] maximum. Ceiling mounted units shall have factory finish to match ceiling color, and be installed with rims tight against ceiling. Sponge-rubber gaskets shall be provided between ceiling or wall and surface-mounted diffusers for air leakage control. Diffuser boots shall be sealed tight to the wall or ceiling they penetrate using duct mastic or caulking. Suitable trim shall be provided for flush- mounted diffusers. Duct collar connecting the duct to diffuser shall be airtight and shall not interfere with volume controller. Wall supply registers shall be installed at least 150 mm [6 inches] below the ceiling. Supply diffusers shall not be located within 1.5 m any light fixture or fixture box intended for future ceiling fan installation.

10-4.2 Return and exhaust grilles. Grilles shall be fixed horizontal or vertical louver type similar in appearance to the supply diffuser face. Plastic units are prohibited. Core velocity shall be limited to 2 m/sec [400 fpm] maximum, with a maximum pressure drop of 0.5 Pa/m [0.06 inch water]. Grilles shall be provided with sponge-rubber gasket between flanges and wall or ceiling. Register/grille boots shall be sealed tight to the wall or ceiling they penetrate using duct mastic or caulking. Wall return grilles shall be located at least 150 mm [6 inches] above the floor. Return grilles shall be located in hallways, finished basements, or other normally unoccupied spaces to minimize the sound level in occupied spaces. Return grilles shall not be located immediately adjacent to furnace return air plenum. Return grilles shall not be locate low in a wall location that may be blocked by furniture such as sofa of bed headboards. **A desirable feature is filter frames in return grilles allowing filter maintenance from inside the living unit**.

10-4.3 Ductwork. Ductwork shall be externally insulated sheet metal or flexible metal. Length of flexible duct shall be limited to 1.8 m [6 ft]. Flexible ductwork shall not be spliced or joined and shall be a single continuous piece from diffuser boot to trunk/branch duct. Systems composed entirely of flexible ductwork with distribution boxes are prohibited. Sub-slab, intra-slab, or crawlspace ductwork is also prohibited. Volume dampers shall be provided at each branch take-off. All ductwork shall be concealed. No portion of the building construction (such as joist space in a floor or ceiling, wall stud space, etc.) shall be used as a duct. The requirements for ductwork set forth below apply to all ductwork installed in the housing unit, supply systems, return systems, exhaust systems, ventilation systems, and outside air supply ductwork.

10-4.3.1 Maximum velocity in supply ducts shall be limited to 4.6 m/s [900 fpm] for mains and 3.1 m/s [600 fpm] for branches.

10-4.3.2 Ducts shall be airtight with no visible or audible leaks to ensure quiet, economical system performance. Ductwork in conditioned spaces shall be constructed for a 250 Pa [1 inch] static pressure construction class with seal class C, as described in the SMACNA HVAC Duct Construction Standard, unless a higher pressure class and/or seal class is required by actual, system operating conditions. Ductwork in unconditioned spaces shall be constructed for a 500-Pa [2-inch] static pressure construction class with seal class C, unless a higher pressure class and/or seal class is required by actual, system operating conditions. All duct seams and joints shall be sealed using duct mastic. Tape shall not be used as a means for sealing ductwork.

10-4.3.3 For flexible ductwork, the inner core shall be mechanically fastened to all fittings, preferably using drawbands installed directly over the inner core and beaded fitting. If beaded fittings are not used, then the inner core shall be fastened to the fitting using #8 screws equally spaced around the diameter of the duct, and installed to capture the wire coil of the inner liner (3 screws for ducts up to 300 mm [12 inch] in diameter and 5 screws for ducts over 300 mm [12 inch] in diameter). The inner core must be sealed to the fitting using mastic or tape. Tape used for sealing the inner core shall be applied with at least 25 mm [1 inch] of tape on the duct lining and 25 mm [1 inch] of tape on the fitting, and shall be wrapped at least three times. The outer sleeve (vapor barrier) must be sealed at connections with a drawband and three wraps of approved tape. The vapor barrier must be complete without any holes or rips, and seams shall be sealed with mastic or approved tape. Pressure sensitive tapes used in conjunction with flexible duct connections shall be as recommended by the duct manufacturer and shall be UL 181A listed and so indicated with a UL 181A mark or aluminum-backed butyl adhesive tape (15 mil minimum). Drawbands shall be stainless steel worm drive hose clamps or UV resistant nylon duct ties.

10-4.3.4 Provide a minimum of 51-mm [2-inch] thick mineral fiber insulation (or other listed insulation with an equivalent R value) on the exterior of all ducts in unconditioned spaces. Exhaust ductwork does not require insulation. Insulation shall be faced with a vapor barrier material having a performance rating not to exceed 1.0 perm. Insulation, vapor barrier, and closure systems shall be non-combustible as defined in NFPA 255, with a flame-spread rating of not more than 25, and a smoke development rating of not more than 50, as defined in ASTM E-84.

10-4.3.5 Return, exhaust, and ventilation air ductwork shall be sized for a maximum velocity of 4.6 m/sec [900 fpm]. Short runs of return air duct (1525 mm [5 ft] or less) which directly precede the air handler or furnace shall be acoustically lined to minimize noise.

10-4.4 Not used.

10-4.5 Filtration. Provide a pleated 25 mm [1 inch] panel filter, sized for and installed in the return air system in accordance with UL 900. Filter shall be rated for 20 percent efficiency as determined by ASHRAE 52, Method of Testing Air Cleaning Devices used in General Ventilation for Removing Particulate Matter. All filters shall be easily accessible for changing and maintenance and shall be installed in the return grilles whenever possible. Additional consideration in the technical evaluation shall be given to designs utilizing electrostatic filters. Kitchen exhaust hoods shall be provided with aluminum grease filters sized to fit the exhaust duct.

10-5 Thermostats and Humidistats. Thermostats shall be located on interior partitions, approximately 1530mm [5 ft] above the finished floor. Locating a thermostat on the wall adjacent to a stairway, on an exterior wall, or where it is subject to unrepresentative temperatures is unacceptable.

10-5.1 Thermostats shall be Energy Star labeled, microprocessor-based, with built-in key pads for scheduling of day and night temperature settings. Thermostats shall be programmable for heating only, cooling only, or heating and cooling as required. When out of the scheduling mode, thermostats shall have continuous display of time, with AM and PM indicator, continuous display of day of week, and either continuous display of room temperature with display of temperature set point on demand, or continuous display of temperature set point with display of room temperature on demand. In the programmable mode, the display shall be used for setting and interrogating time program ON-OFF set points for all 7 days of the week. The time program shall allow two separate temperature-setback intervals per day. Thermostats shall have a means for temporary and manual override of the program schedule, with automatic program restoration on the following day. Thermostats shall have a replaceable battery to maintain the timing and maintain the schedule in memory for one year in the event of a power outage. Maximum differential shall be ±1 degree C [±2 degrees F]. For a listing of Energy Star labeled thermostats see http://www.epa.gov/appdstar/hvac/thermostats.html.

10-6 . Not used.

10-7 Exhaust Fans. **K**itchen range hood exhaust fans shall be ducted to the outside. Exhaust fans shall not discharge near the air conditioning condensing unit, entry doors, patio or balconies, carports **(AM#4)**. Fans shall be tested and rated in accordance with AMCA 210, and shall operate with 120-volt, single-phase power supply. Exhaust fans shall be provided with backdraft damper. **(AM#3)**. Kitchen range exhaust fans shall be two-speed, and shall be sized for an exhaust rate of 7.6 (L/s)/m^2 [1.5 cfm/ ft^2]. Maximum allowable noise level for range hood exhaust fans shall be 6 sones as installed.

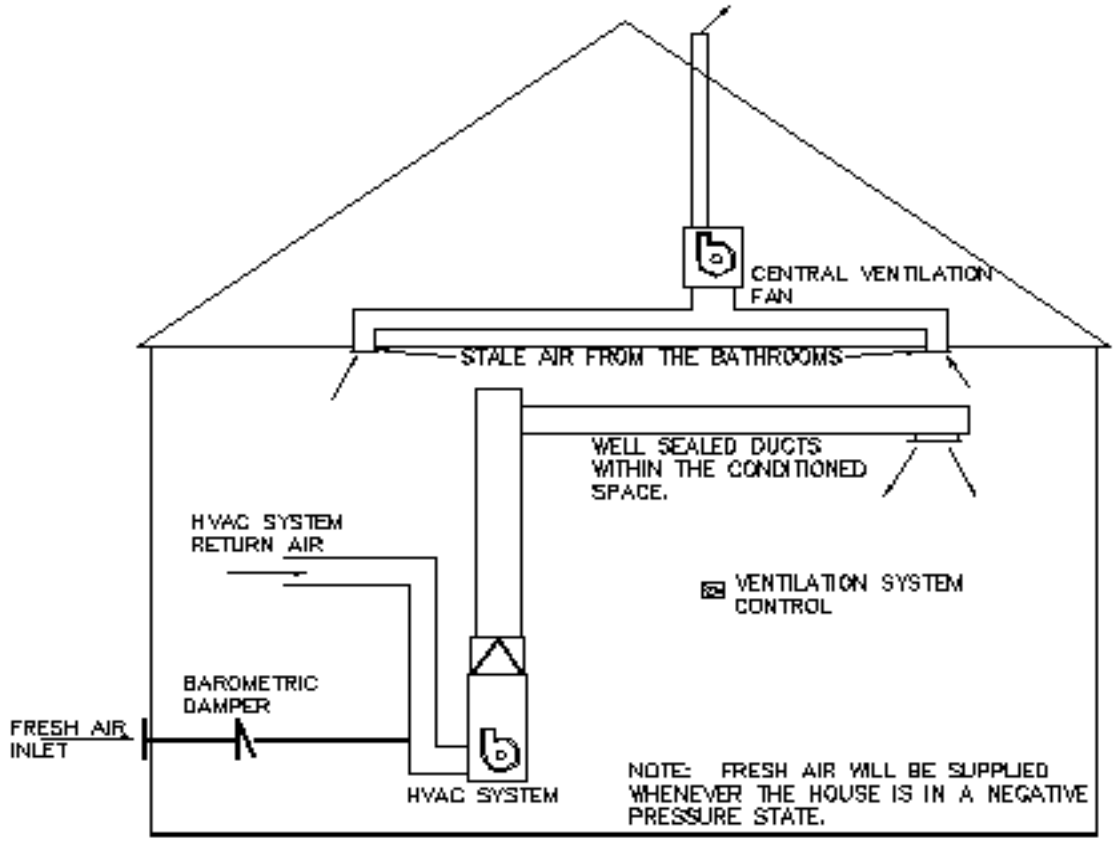
10-8 Dryer Vents. A 100-mm [4-inch] diameter dryer vent shall discharge to the exterior, and provide connection to occupant-owned dryer (one dryer per vent). The vents shall be rigid aluminum with exterior wall cap and backdraft damper. Vent pipes shall be a maximum of 6100 mm [20 ft] long, with no more than three right angle elbows (with minimum radius of 150 mm [6 inches]), and have a maximum vertical run of 3660 mm [12 ft]. Dryer vents shall not exhaust near the air conditioning condensing unit, entry doors, patio or balconies, carports **(AM#4)**. Dryer vents shall not run through non-accessible spaces **(AM#4)**. **A desirable feature is horizontal dryer venting. Vertical dryer venting through roof is discouraged.**

10-9 **Ceiling Fans. Provision of ceiling fans is encouraged as a means of increasing occupant comfort, and as an aid to improve the performance of heating and cooling systems. Ceiling fans with lights may be substituted for ceiling fixture requirements in bedrooms, dining room, living room, and family room. Ceiling fans will be low profile 1050 – 1350 mm (42-52 inch), four blade type. Motors shall be three speed reversible, with air volume range between 600 and 3300 l/s (1300 and 7000 cfm) and speeds between 75 and 225 rpm. Maximum power consumption shall be 80 watts and 0.7 amps. Manufacturer's 20 year warranty is required. (AM#2)**

10-10 Piping Requirements. Air conditioner condensate drains, refrigerant suction, and exterior refrigerant liquid lines shall be insulated with 25 mm [1 inch] (minimum) thick cellular glass or unicellular foam pipe insulation. Exterior refrigerant line insulation shall be encased in either an aluminum or PVC jacket to prevent damage. Condensate lines shall be one size larger than the drain pan connection, be properly trapped, and not directly connected to a sanitary sewer system (air gap fitting required).

10-11 Radon Mitigation. Due to moderate level Radon test readings in the area, both passive barriers and sub-slab suction system are required for every housing unit in accordance with TI 810-91. The passive barrier consists of a capillary water barrier and 6 mil polyethylene sheet under floor slab as well as sealing all pipe and conduit penetrations of floor slab. The sub-slab suction system consists of a 100mm (4 inch) diameter perforated PVC piping system located in the capillary water barrier connected to a non-perforated 100 mm PVC pipe stubbed up through the floor slab and capped for future extension to an exhaust fan. See paragraph 14 for additional requirements.

10-12 Active Ventilation Engineered IAQ Enhancement. The bathroom exhausts, within each unit, shall all be ducted together to a common exhaust plenum equipped with a single long-life, low cfm, two-speed fan. The fan shall be sized to provide the required exhaust rate in each bathroom space when operated at low speed. Control for this fan shall be accomplished from a wall mounted switch, located in the linen closet, labeled HI-LOW-OFF. The OFF position of the switch shall illuminate a “RED” LED to indicate the off condition of the ventilation system. The supply ventilation portion of the system shall consist of a small duct providing a connection for fresh (outdoor air) air to the furnace return duct. This duct shall contain a barometrically-controlled vent which shall admit outdoor air to the unit whenever the housing unit is experiencing a negative pressure. ASHRAE 62-1989, “Ventilation for Acceptable Indoor Air Quality” recommends ventilation air supply rate at a minimum of 0.35 air changes per hour (ACH) but not less than 15 cfm per person. This is supplied by either natural infiltration or a combination of natural infiltration plus active ventilation. The fresh air supply duct shall be sized to provide no more than this minimum 0.35 Air Changes per hour maximum ventilation rate (but in no case shall the ventilation air introduced into the unit from the combination of natural infiltration and active ventilation be less than recommended by ASHRAE 62 with consideration for two (2) occupants per bedroom). This system is a recommended “Energy Star Homes” approach for improving indoor air quality in residential construction. The Active Ventilation Engineered IAQ Enhancement described in this paragraph is considered to be a minimum level compliance item (See Diagram below.) in weather regions 5 through 11. In weather regions 1-4 extreme cold conditions and energy efficiency considerations may require the use of alternate approaches, some including heat recovery ventilators (HRV). Contractors are encouraged to present and propose other systems/methods which are enhancements/improvements to the system described and can ensure adequate fresh ventilation air (0.35 AC/Hr Max) is provided to the interior spaces of the housing units. Contractors are encouraged to review “Energy Star” materials and information available to them through the EPA and/or by visiting the Energy Star Web page. See, for example, http://yosemite.epa.gov/appd/eshomes/eshaware.nsf/attachments/lib/$file/BalancedVentSys.pdf and http://yosemite.epa.gov/appd/eshomes/eshaware.nsf/attachments/lib/$file/SupplyVent.pdf.



ACTIVE VENTILATION SYSTEM SCHEMATIC

10-13 Testing, Adjusting, and Balancing. Adjusting and balancing of each housing unit shall be the Contractor's responsibility. Following adjusting and balancing, testing of air and water systems shall be performed on 10 percent of the project buildings (not to exceed 10 buildings), which have been randomly selected by the Contracting Officer. If buildings are to be turned over in phases, testing shall be performed on 10 percent of the buildings completed in each phase (not to exceed 10 buildings per phase). No additional testing will be required if at least 90 percent of the tested buildings pass the test requirements. If less than 90 percent of the tested buildings pass the test, an additional 10 percent of the project buildings (not to exceed 10 buildings) shall be tested. This process shall continue until 90 percent of the total number of tested buildings pass. The contractor shall correct all housing units not found in compliance, and shall be responsible for all labor and materials required for this effort. AABC MN-1, NEBB-01, SMACNA-07 or ASHRAE 111 shall be used as the standard for providing testing of air and water systems. The selected standard shall be used throughout the project. Instrumentation accuracy shall be in accordance with the standard selected. Testing shall be accomplished by a firm certified for testing by the Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB). Prior to testing, adjusting, and balancing, the Contractor shall verify that the systems have been installed and are operating as specified. Where specific systems require special or additional procedures for testing, such procedures shall be in accordance with the standard selected. Approved detail drawings and all other data required for each system and/or component to be tested shall be made available at the job site during the entire testing effort. Testing shall not commence until approved by the Contracting Officer. The facility shall be essentially complete with final ceiling, walls, windows, doors, and partitions in place. Doors and windows surrounding each area to be balanced shall be closed during testing and balancing operations. Air systems, hydronic systems, and exhaust fans shall be complete and operable. All data, including deficiencies encountered and corrective action taken, shall be recorded. Following final acceptance of certified reports by the Contracting Officer, the setting of all HVAC adjustment devices shall be

permanently marked by the Contractor's balancing engineer so that adjustment can be restored if disturbed at any time.

10-14 Duct Tightness Testing Requirements. The installation of the supply and return ductwork within the units is an item of prime concern with respect to the energy efficient operation of the housing unit as a whole. With that consideration in mind, for heating and air conditioning designs which include ductwork outside of the conditioned envelope, the contractor will be required to test the proto-type units and all units which are blower door tested for tightness (see paragraph 7-3.2) to ascertain the leakage levels from the ductwork in accordance with the following requirements. For system designs which place all the ductwork within the conditioned envelope of the structure or systems which utilize evaporative cooling, no ductwork testing will be required.

10-14.1 Duct tightness testing shall ensure that the leakage rate from ductwork (where the ductwork system is not entirely within the conditioned envelop) shall not exceed 0.15 $(L/s)/m^2$ [0.03 cfm/ft^2]. If the units tested fail to meet this requirement, the ductwork installation shall be examined, corrections made, and the test redone until the installation passes this requirement. No ductwork systems may be installed in other units until the proto-type units ductwork systems have been validated. Several methods to accomplish this testing are acceptable

10-14.1.1 Testing may be done in accordance with ASTM Standard E 1554-94, “Determining External Air Leakage of Air Distribution Systems by Fan Pressurization”. This method describes the process and methodology required to accomplish basically a ‘blower door subtraction’ method of duct tightness testing.

10-14.1.2 Testing may also be accomplished utilizing “Duct Blaster” methodologies and pressurizing the ductwork to 25 Pascal [0.1 inch of water].

10-14.2 The contractor is advised that the EPA may test, or hire a consultant to test randomly selected housing units constructed in this project. These tests will be completed without cost to the contractor, however, the contractor will be required to coordinate access to the selected unit. If accomplished, this testing is not expected to interfere or delay the construction contractor in any manner.

11. ENERGY CONSERVATION.

11-1 Energy conservation techniques shall be considered as they relate to site design, site engineering, unit design, and unit engineering. Techniques which conserve energy, improve livability, and can be justified by life cycle cost analysis as cost effective are encouraged. Integration of energy conservation systems with the housing unit's design (lighting, structure, mechanical systems, and aesthetics) is essential to facilitate livability and maximum energy savings. If an alternative energy generation method is intended for use as the project's primary energy source, documentation shall be submitted to the Contracting Officer, verifying the system's reliability and ability to meet the project's peak demand. The following paragraphs suggest energy conservation techniques which are considered desirable. The listing is not all inclusive, and the techniques suggested may not be cost effective at a given location or site. Additional consideration in the technical evaluation will be given to designs which incorporate valid energy conservation techniques.

11-2 Passive Solar Applications. Passive solar architectural applications shall routinely be considered as a part of all project designs.

11-2.1 Not used

11-2.2 Storage mass. If thermal performance calculations indicate a need for additional mass (beyond that provided by the housing unit structure) substantiating data will be submitted. The storage mass will be well integrated into the housing unit design. The thermal mass surface area in the space must be a minimum of three times the glazing area. Six to nine times the glazing area is recommended to control temperature swings. The surfaces to absorb solar energy must not be more than 10% covered.

11-2.3 Shading. Movable window treatments are required. These shall be metal blinds. Cooling season shading of glazed surfaces on the east, west, and south elevations shall be considered.

11-3 Not used.

11-4 Not used.

11-5 Not used.

11-6 Condenser Heat Recovery. In regions authorized for cooling, consideration shall be given to installation of a heat exchanger to recover condenser heat and desuperheat for use in heating domestic water. A standard, domestic water heater shall be provided in conjunction with this system to provide hot water during the heating season. Heat pump water heaters can be considered in hot climates.

11-7 Not used.

11-8 Systems and techniques which take advantage of rebates and incentives offered by utilities are preferred and shall be stated by the government and local utility districts.

12. CONTRACTOR PREPARED SPECIFICATIONS

12-1 The successful offeror shall prepare a specification for all work included in the scope of work. The specification shall be tailored to this job. Inapplicable materials shall be deleted. Any reference, description, procedure or other matter required to develop a complete, accurate and concise specification shall be provided. The specification shall include but is not limited to:

12-1.1 A description of the technical requirements

12-1.2 Criteria for determining whether the requirements are met

12-1.3 Quality control requirements and procedures

12-2 Specifications for features of the work shall be organized into divisions and sections in accordance with Construction Specifications Institute (CSI), Master List of Titles and Numbers for the Construction Industry, latest edition. See **Section 01016 (AM#4)** DESIGN DOCUMENT REQUIREMENTS for additional requirements.

12-3 Individual specification sections shall be in the format of CSI, Section Format, A Recommended Format for Construction Specification Sections, latest edition. Exceptions are:

12-3.1 Measurement Procedures and Payment Procedures shall only be used in those section(s) where rock excavation is specified. No other sections shall contain these subparagraphs of the paragraph SUMMARY.

12-3.2 Except as otherwise noted in this paragraph, CONTRACTOR PREPARED SPECIFICATIONS, the paragraph SUMMARY shall not be used.

12-3.3 Submittal requirements, submittal procedures, quality control procedures, and construction operations shall be those contained in the attached **(AM#4)** Section 01320, Section 01330, including the submittal register, Section 01451, Section 01500, Section 01560, and Section 01770. These specification sections shall be incorporated into the contractor prepared specification packages without editing and shall be coordinated with all other specification sections prepared by the contractor.
12-3.4 Section 09900, PAINTS AND COATINGS; shall establish a minimum level of quality for paints, stains, and varnishes to be used in this project.

12-4 Not Used.

12-5 Not Used.

12-6 Contractor prepared specifications shall be reviewed by the Contracting Officer or his designated representatives during the design portion of the project. Contractor will incorporate all required changes after resolution of comments and prior to work initiation on the next phase of the project.

13. SUSTAINABLE DESIGN CONSIDERATIONS:

13-1 Sustainable design techniques shall be considered as they relate to site design, site engineering, unit design, and unit engineering. Techniques which conserve energy, improve livability, and can be justified by life cycle cost analysis as cost effective are encouraged. Integration of energy conservation systems with the housing unit's design (lighting, structure, mechanical systems, and aesthetics) is essential to facilitate livability and maximum energy savings. The following paragraphs define the goals and general objectives for inclusion of sustainable design considerations in this project. This information is taken from US Army Corps of Engineers, ETL 1110-3-491. The listing is not all inclusive, and the techniques suggested may not be cost effective at a given location or site. **(AM#6)**

13-2 Goals and Objectives of Sustainable Design.

13-2.1 The overall USACE goal of Sustainable Design is to be environmentally responsible in the delivery of facilities. The key traditional elements for decision making in the facility delivery process are cost, quality and time. These elements need to be expanded to include the ecological and human health impacts of all decisions.

13-2.2 Each project generates its own set of goals. However, sustainable design goals should apply to all projects. The goals for improving the environmental performance of facilities include: (a) use resources efficiently and minimize raw material resource consumption, including energy, water, land and materials, both during the construction process and throughout the life of the facility, (b) maximize resource reuse, while maintaining financial stewardship, (c) move away from fossil fuels towards renewable energy sources, (d) create a healthy and productive work environment for all who use the facility, (e) build facilities of long-term value, and (f) protect and, where appropriate, restore the natural environment.

13-3 Sustainable Design and Construction of the Built Environment. Design and construction of sustainable buildings should be in accordance with the following concepts:

13-3.1 Site Work and Planning--Environmentally sensitive planning looks beyond the boundary of the project site to evaluate linkages to transportation and infrastructure, ecosystems and wildlife habitat and community identification. Site planning evaluates solar and wind orientation, local microclimate, drainage patterns, utilities and existing site features to develop optimal siting and appropriate low maintenance landscape plant material.

13-3.2 Building Layout and Design--Optimize building size, and maintain an appropriate building scale for the environment and context of the building or a building component. Layout the rooms of a building for energy performance and comfort, and design for standard sizes to minimize material waste. Pay careful attention to the location of exterior windows. Avoid structural over-design and the resultant waste. Design components of the building environment for durability and for waste recycling.

13-3.3 Energy--Building orientation and massing, natural ventilation, day-lighting, shading and other passive strategies, can all lower a building's energy demand and increase the quality of the interior environment and the comfort and productivity of occupants.

13-3.4 Building Materials--Environmentally preferable building materials are durable and low maintenance. Within the parameters of performance, cost, aesthetics and availability, careful selection and specification can limit impacts on the environment and occupant health.

13-3.5 Indoor Air Quality--Indoor air quality is most effectively controlled through close coordination of architecture, interiors and mechanical, plumbing, and electrical design strategies that limit sources of contamination before they enter the building. Construction procedures for IAQ and post-occupancy user guides also contribute to good long-term IAQ.

13-3.6 Water Usage-- Site design strategies that maximize natural filtration of rainwater are desirable. Water

conservation is enhanced by the use of low flow plumbing fixtures and water appropriate landscaping.

13-3.7 Recycling and Waste Management--Waste and inefficiency can be limited during construction by sorting and recycling demolition and construction waste, reuse of on-site materials and monitoring of material use and packaging. Accommodating recycling into building design reduces waste while generating revenues.

13-3.8 Building Commissioning, Operations and Management--Effective building commissioning is essential to ensure proper and efficient functioning of systems. Facilities operations benefit from energy and water saving practices, waste reduction and environmentally sensitive maintenance and procurement policies.

14. ENVIRONMENTAL.

14-1 Environmental Assessment. A Final Environmental Assessment (EA) for New Housing Construction, Patch-Chaffee Area, Fort Sam Houston (FSH), Texas, dated December 2000, has been completed for the proposed action of constructing new family housing units adjacent to the Patch-Chaffee area. There is a FINDING OF NO SIGNIFICANT IMPACT (FONSI) for this proposed action. This proposed action is in compliance with the National Environmental Policy Act (NEPA) of 1969 (Public Law 91-190), as amended. These units will replace 70 existing housing units at the Harris Heights community. Demolition of the existing housing units at Harris Heights will be under a separate contract after completion of new housing and relocation of tenants. The other demolition contract will include work tasks such as environmental sampling/survey, environmental abatement, physical structures and utilities demolition, and necessary site restoration.

14-2 Protection Of Historical Properties And Cultural Resources. The proposed site for new housing at Patch-Chaffee is adjacent to the proposed National Historic Landmark District (NHLD). The proposed construction may have the potential to affect the historic landscape of the Patch-Chaffee area. However, the new housing units will be constructed to preserve the FSH historic heritage in accordance with FSH Installation Design Guide (IDG) and Historic Landscape Master Plan. In addition, the Secretary of the Interior's Standards for Historic Preservation will be utilized in developing the design. Therefore, no adverse impact to the historic landscape is expected.

14-3 Protection of Biological Resources. The new housing construction will not result in adverse impacts on flora and fauna because construction would occur in existing residential areas. The few trees and shrubs removed during construction activities will be replaced during landscape planting of these areas. The Historic Landscape Master Plan for FSH has been adopted for the entire installation, and requires xeriscape landscaping for all new re-vegetation efforts. Xeriscaping will primarily utilize drought-tolerant species of grasses, perennials, ground covers, vines, shrubs, and trees. Removal of trees is best accomplished during late summer to early spring (mid-August to beginning of February) in order to avoid destroying bird nests and to be in compliance with the Migratory Bird Treaty Act.

14-4 Land Use and Visual Resources. The existing land use category will need to be revised to a family housing category. Development on vacant lots will result in a slight beneficial impact on land use. The adjacent area will remain residential, and the overall quality and character of the neighborhoods will be enhanced by the replacement of vacant lots with new homes consistent with the existing architectural styles. The land use category will be consistent with the Real Property Management Plan (RPMP) goals and objectives, and especially in reducing the FSH housing deficit.

14-5 Water Resources. The proposed site for new construction is not located within a floodplain or wetland area. Construction in the Patch-Chaffee area, an already disturbed area, is not anticipated to impact surface water resources at FSH. The overall increase in housing units after project completion will not significantly impact aquifer water level because of utilizing water-saving fixtures units, and landscaping with xeriscape methods.

14-6 Utilities: The removal of existing housing units in the Harris Height community will off-set the demand of water, gas, or electricity. In addition, the Water Use Reduction Program will encourage water conservation practice on post. Mechanical designer for new housing will utilize an energy conservation system for heating and cooling. The new housing shall use new, energy efficient building products to reduce electrical powder demand. Therefore, there is no increase in electrical power consumption anticipated due to the proposed action.

14-7 Noise Impact: Noise resulting from construction activity is anticipated to be moderate, short-term, and generated only during regular working hours. Noise level is expected to return to normal levels after completion of construction. Noise level within the Patch-Chaffee area will slightly increase upon occupancy, but will not have significant impact.

14-8 Water Quality and Prevention of Water Pollution.

14-8.1. Water Supply. The pressure, quantity, and quality of the existing water supply system are adequate for the family housing development. New water lines and valves, etc., will be designed and constructed under this contract. See further discussion of the water distribution system in Section 01001 Statement of Work, paragraph 4- SITE ENGINEERING.

14-8.2 Municipal Wastewater. The existing sanitary system is adequate for the family housing development. New sewer lines, manholes, etc., will be designed and constructed under this contract. See further discussion of the sanitary sewer system in Section 01001 Statement of Work, paragraph 4- SITE ENGINEERING.

14-8.3 Industrial Wastewater. No industrial wastewater will be generated during construction.

14-8.4 Protection of Surface and Storm Water. Construction sites that are two (2) ha (or 5 acres) in size or larger are required to have a National Pollutant Discharge Elimination System (NPDES) Storm Water Construction Permit. In accordance with Federal Register, Volume 63, Number 128, July 6, 1998, the Contractor/designer shall prepare a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP narrative and the Erosion and Sediment Control Plans shall be prepared and submitted in accordance with specifications Section 01421 – Basic Storm Water Pollution Prevention Plan.

14-9 Air Quality and Prevention of Air Pollution

14-9.1 The construction of new housing in the Patch-Chaffee area will have an insignificant impact on the air resources of the region. Construction activities will have short-term and minor adverse impacts on air quality by increasing fugitive dust emissions. However, these increases will be temporary and localized.

14-9.2 Burning of debris and waste material at the project site is prohibited.

14-9.3 Dust control practices and other particulate emissions during construction shall be in compliance with the Clean Air Act (CAA) , Texas Clean Air Act (TCAA), and in accordance with specification Section 01561 DUST CONTROL.

14-9.4 The Final Environmental Assessment, dated December 2000, indicated no concern for radon. However, the email message (dated February 2002) from Mr. David Walker (Fort Sam Houston Directorate of Safety, Environment and Fire Compliance Branch), stated some current radon readings on base were above 4 picocurries (pCi/l) and one reading was as high as 13 pCi/l. Since then, a design directive on radon has been requested from the Directorate of Safety, Environmental and Fire Compliance Branch. The design directive is not available during the preparation of this document; therefore, the most current and the highest radon measurement (13 pCi/l) in one existing building in close proximity to the proposed housing units, is used to determine the design requirements for radon prevention in this contract. Based on this reading (13 pCi/l) per TI 810-91, INDOOR RADON PREVENTION AND MITIGATION (dated August 1998), design requirements for radon prevention shall consist of Passive Barriers (Letter Code A) and Sub-slab Suction Systems (Letter Code C) for the proposed family housing units. These requirements shall be incorporated in the mechanical, and structural/foundation design for the proposed family housing units (also reference paragraphs UNIT DESIGN- HEATING, VENTILATING, AND AIR CONDITIONING and UNIT DESIGN- STRUCTURAL in this document). Prior to the preparation of design documents, the Contractor shall verify, with the Directorate of Safety, Environment and Fire Compliance Branch, if 13 pCi/l is still the highest radon measurement in the existing buildings. The Contractor shall use the latest and the highest radon measurement to verify the design requirements (Letter Codes) per TI 810-91 for radon prevention.

14-10 Municipal Solid Waste. The Contractor shall dispose of municipal solid waste and demolition debris off-post at their own expense.

14-11 Regulated Waste. Regulated materials such as asbestos, lead-based paint, or pesticides are not anticipated in the construction of new housing. An environmental survey, sampling, and abatement of

regulated materials is not required in this contract. If removal of utility poles or pole–mounted, wet-type transformers are required, the Contractor shall notify the Contracting Officer's Representative and the Directorate of Safety, Environment, Fire and Compliance Branch.

14-12 Fuel Contaminated Area. The contaminated area is located at the southeast area of the block that is bound on the north by Taylor Road, on the south by Wilson Street, on the west by Road No. S-23, and on the east by an unnamed dirt road which is an extension of 15th Street (south of Wilson St. and intersects Wilson St. and Taylor Road). This block was intended to be a part of the initial proposed family housing project site. The contaminated area is the previous location of a demolished aircraft hangar maintenance shop B/1198. As requested by the Corps of Engineers, CESWF-PER-DD, one composite soil sample was obtained by CESWF-EC-DG at five (5) separate sub-sample locations around the perimeter of the previous hangar footprint. For screening purposes, the composite sample was analyzed for eight (8) RCRA metals, Total Petroleum Hydrocarbon (TPH, Method TNRCC 1005), and Semi-Volatile Compounds (EPA method 8270). The composite soil sample had several fuel constituents as well as metals. The levels of fuel constituents in the composite soil sample cannot be compared to TNRCC Texas Risk Reduction Program (TRRP), 30 TAC 350, regulations because they are not from a discrete sample. The results indicate at least one of the soil sub-samples is contaminated and the previous hangar site has a fuel release but the horizontal and vertical extent of contamination is unknown. In addition, there are four (4) soil borings obtained from this entire block, soil borings locations are different from the sub-sample locations for soil analysis, but no groundwater is detected from ground surface to 13 feet depth. The sites of demolished Buildings No. 1194, 1195, and 1144 are in the same block and north of the previous hangar B/1198. From information provided by the Directorate of Safety, Environment and Fire Compliance Branch, these demolished buildings were administrative offices. Because the extent of contamination is unknown, the Directorate of Safety, Environment, Fire and Compliance Branch is recommended by the Corps of Engineers to pursue reporting of a release, and further environmental investigations to delineate extent of contamination, with guidance from TNRCC through another contract. Therefore, construction work is not recommended in the entire block (see description above) under this contract.

14-13 The Proposed Project Site. The proposed location for the family housing project (excluding the block that contained the previous hangar site, see par. 14-12) is described in paragraph 1-2.3.2. The proposed site is currently unoccupied. Based on the1985 site plan list, the following structures were demolished: P-1100 Swimming Pool, T-1101 Bath House, T-1119 Enlisted Barracks, T-1123 Drug & Alcohol Abuse Center, T-1126 Laboratory, T-1172 Battalion HQ, T-1173 Facility Engineer Storehouse, T-1174 Warehouse, T-1175 Maintenance Shop, T-1176 Warehouse. The FSH Directorate of Safety, Environment, Fire and Compliance Branch has verified that the proposed project site has no known contamination from previous activities of the demolished facilities, based on the Preliminary Assessment/Site Investigation (PA/SI) study (dated September 1998) under another contract.

14-14 Construction Material for New Housing Units.

14-14.1 Construction material shall not contain any asbestos.

14-14.2 Potable water supply system shall have lead free pipes and joints.

14-14.3 Paint to be used for the new housing units shall have a certificate stating that the paint does not contain more than 0.06 percent lead by weight of the total non-volatile compounds, mercury containing mildewcide, insecticide, and it meets the Federal Volatile Organic Compound (VOC) regulations and state air pollution requirements.

14-14.4 Pesticides, fungicides, or insecticides utilized for foundation treatment or grass fertilization shall be EPA approved. It shall be applied by licensed and certified personnel with licensed equipment and transporter.

14-15 Federal, State, Local Permits and Notifications.

14-15.1 EPA's NPDES Storm Water Construction Permit. This permit is required for storm discharges prior

to construction. All submittals shall be in accordance with Section 01421 Storm Water Pollution Prevention Plan. EPA administers the NPDES Storm Water Construction Permit program for larger than 2.0 hectares (or 5 acres) construction sites until July 3, 2003. Texas Pollutant Discharge Elimination System (TPDES) will administer the Storm Water Construction Permit for construction sites larger than 2.0 hectares (or 5 acres) after July 3, 2003. The Contractor shall evaluate the time frame of the construction activities and determine if the permitting authority has shifted from EPA to Texas Natural Resource Conservation Commission (TNRCC). Section 01421 shall be edited to reflect this change, if necessary

14-15.2 Notice of Intent (NOI). The Contractor shall submit NOI prior to construction. NOI shall be submitted no later than 48 hours before start of construction.

14-15.3 Storm Water Pollution Prevention Inspection and Maintenance Report. The Contractor shall submit Inspection & Maintenance Reports during construction in accordance with Storm Water Construction Permit and Section 01421 Storm Water Pollution Prevention Plan.

14-15.4 Notice of Termination (NOT). NOT shall be submitted upon completion of each construction contract.

14-15.5 The Contractor shall supply a "Customer Service Inspection" certificate for the water supply in accordance with the TNRCC regulations. The completed and signed certificate shall be submitted to the Contracting Officer for review and final approval.

14-15.6 The Contractor shall allow adequate time to obtain digging permit from DPW prior to any digging, drilling or excavation activities.

14-15.7 Per TAC 30, rule 290.39, the plans and specifications of the water distribution and wastewater collection systems prepared by the design and build Contractor shall be reviewed and approved by Texas Natural Resource Conservation Commission (TNRCC) for obtaining a public water system permit. Typically, the review process may require 30 to 60 days.

14-15.8 Backflow preventers shall be certified to operate in accordance with state regulations. Testing of backflow preventers shall be performed by certified personnel. If no State requirement exists, the Contractor shall have the manufacturer's representative test the device to ensure the unit is properly installed and performing as intended. The Contractor shall provide written documentation, at the time of the final inspection for the facility, stating that the tests have been performed and that the backflow preventers operate properly in accordance with State regulations. The individual performing the tests shall sign this documentation.

SECTION 01016

DESIGN DOCUMENT REQUIREMENTS
09/2001
AMENDMENTS NO. 0002, 0005 and 0006

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

ACI INTERNATIONAL (ACI)

ACI SP-66	(1994) ACI Detailing Manual

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(2000) Structural Welding Code - Steel

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)

ICBO Bldg Code	(1997) Uniform Building Code (3 Vol.)

MILITARY HANDBOOKS (MIL HDBK)

MIL HDBK 1008C	(10 June 1997) Fire Protection For Facilities Engineering, Design and Construction

US ARMY CORPS OF ENGINEERS, SOUTHWESTERN DIVISION (SWD)

SWD-AEIM	(October, 2000) Architectural and Engineering Instructions Manual (SWD-AEIM)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-05 Design Data

Design Data Checklists; .

Include the Fire Protection, Code Analysis, and Handicapped Checklists (Attachments A, B, and C) at the end of this Section with the Design Analysis and submit with the design submittals. Design Analysis shall include a section discussing Environmental Design, indicating issues and considerations during project programming stage, and design features in the final design.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 DRAWINGS

Prepare, organize, and present drawings in the format specified. Provide drawings complete, accurate, and explicit enough to show compliance with the Contract requirements and to permit construction. The layout of individual sheets and the organization of the assembled set shall follow and communicate a logical sequence. General information shall be presented first, progressing to more detailed information. When assembling details, begin in the upper left-hand corner of the sheet with letters progressing to the right and down. Drawings illustrating systems proposed to meet the requirements of the Contract performance specifications shall reflect proper detailing for each such system to assure appropriate use, proper fit, compatibility of components, and coordination with the design analysis and specifications required by this section. Coordinate drawings to ensure there are no conflicts between design disciplines and between drawings and specifications. For specific drawing requirements, see paragraphs: DESIGN DEVELOPMENT (60 PERCENT PRELIMINARY DESIGN) REQUIREMENTS and CONSTRUCTION DOCUMENTS (100 PERCENT DESIGN) REQUIREMENTS.

The following subparagraphs cover general drawing requirements and supplement those specified in SWD-AEIM, Chapter VIII DRAWINGS.

3.1.1 CADD Drawings

The Contractor shall ensure that all delivered CADD digital files and data (e.g., base files, reference files, cell/block libraries) are compatible with the Government's target CADD system and operating system, which is Bentley Systems MicroStation, version 7.01, running on Microsoft Windows 95/NT, and adhere to the standards and requirements specified. The term "compatible" means that data is in native digital format i.e. .dgn, and can be accessed directly by the target CADD system without translation, preprocessing, or postprocessing of the digital data files. It is the responsibility of the Contractor to ensure this level of compatibility.

3.1.2 CADD Standards

CADD drawings shall be prepared in accordance with the applicable general and discipline-specific provisions for drawing formats, title blocks, borders, level/layer assignments, line colors, line weights, and line types of the "Tri-Service A/E/C Standards" and the "SWD Architectural and Engineering Instruction Manual (AEIM), Chapter VIII, "Drafting Standards."

The CADD standards for design of this project, including seed/prototype files containing the Government's preset standard settings and electronic reference files containing the Government's standard border/title block sheets, are located at the following Web site:

http://tsc.wes.army.mil/products/standards/aec/aecstdweb.asp.

The Contractor shall submit a written request for approval of any deviations from the Government's established CADD standards. No deviations will be permitted unless prior written approval of such deviation has been received from the Government.

3.1.3 Size of CADD Drawings

The Contractor has the option of using either Metric or English units of measure. The Overall Size of CADD drawings shall be **SI A1 (841 mm by 594 mm (33.11 by 23.39 inches) (AM#2)**, at the trim line. Full size drawings shall be submitted for all design submittals. SI Metric or **English (AM#2)** working units and the District's standard file-naming convention shall be used.

3.1.4 .CAL Files

In addition to copying the electronic CADD drawing files to the Submittals' CD-ROM disk, include the drawings in .cal format so that the drawings may be viewed on screen using MaxView Reader that is located on the Solicitation and Contract CD-ROM disk. Include a "sendable" compiled Project.svd index file, created with MaxView Author, so that the drawings may be viewed by double-clicking on this file. MaxView's web site is http://www.maxview.com. Keep the CADD files and the .cal files in separate folders.

3.1.5 Drawing Format

Title block shall include, as a minimum, project title and location, sheet title, and sequence number. For each design submittal, each Contractor-prepared drawing shall bear the printed name and signature of the registered architect or appropriate registered engineer responsible for the work portrayed on that drawing and proposed to meet the Contract requirements. For the final submittal, each Contractor-prepared drawing shall bear the stamp or seal and signature of the registered architect or appropriate registered engineer responsible for the work portrayed on that drawing and proposed to meet the Contract requirements.

3.1.6 Drawings Sequence

Arrange drawings by design discipline in accordance with the SWD-AEIM, Chapter VIII, Appendix A, Plate D1, Standard Arrangement Of Drawings.

3.1.7 Drawings Required

As a minimum, the construction drawings shall consist of the following:

a. Cover or Title Sheet

b. Index of Drawings (each technical discipline shall have a separate drawing legend sheet located in front of each respective section), Legend, and Abbreviations

c. Civil/Site Drawings, including Utility Drawings (Water Supply, Wastewater, Gas, Electrical, Fiber and Communication)

d. Soil Boring Locations and Logs of Borings

e. Turfing and Landscaping Drawings

f. Architectural Drawings

e. Interior Design Drawings

f. Structural Drawings

g. Mechanical Drawings

h. Fire Protection Drawings

i. Electrical Drawings (including communications, security and fire alarm)

j. Lightning Protection

k. Environmental Drawings

l. Schedules - e.g. Doors, Windows, Interior Finishes, Equipment

3.1.8 Drawing Scales

Work shall be drawn at the scales listed below. All disciplines should use the same scale for plan sheets. Scale for all drawings and delineation will permit complete legibility. A graphic bar or checkerboard scale will be provided on each sheet near the lower left hand corner of the sheet. Unless specified elsewhere, conventional scale standards are as follows:

	METRIC (SI) (ENGLISH)
Site Plans (Buildings)	No smaller than 1:200 (No smaller than 1-inch = 30 feet)
Floor Plans (Note 1)	1:50 (1/4-inch = 1 foot)
Roof Plans	1:50 (1/4-inch = 1 foot)
Exterior Elevations	1:50 (1/4-inch = 1 foot)
Interior Elevations	1:20 (3/4-inch)
Cross Sections	1:50 (1/4-inch)
Wall Sections (Note 3)	1:20 (3/4-inch = 1 foot)
Stair Details	1:20 (3/4-inch = 1 foot)
Details (Note 2)	1:5 or 1:10 (3 inches or 1 1/2 inches = 1 foot)
Reflected Ceiling Plans	1:500 (1/4-inch = 1 foot)
Interior Toilet Elevations	1:20 (3/4-inch = 1 foot)
Wall Types	1:5 or 1:10 (3 inches or 1 1/2 inches = 1 foot)

Notes:

1. Scale of composite plans shall be as required so that the entire facility is drawn on one sheet without break lines.

2. The details shall be large enough to show all fixtures, accessories, equipment, materials, manner of construction, clearances required for proper maintenance, and complete dimensions. Toilet rooms and Equipment rooms are examples of the kind of spaces which shall be drawn as a Detail Plan. All details containing sheet metal flashing shall be 1:5 (3 inches = 1 foot).

3. May be 1:20 if pertinent details are shown at larger scale.

3.1.9 North Arrows

North arrows shall be oriented the same direction on all plan sheets and by all disciplines, including site and civil drawings. Plan north shall be

"up" or to the left on the drawings. Indicate true north on composite plan drawings.

3.1.10 Legends and Symbols

Standard material symbols used on the drawings shall be provided as a separate legend drawing located just in front of the drawings in the set. Add additional material symbols to the Legend Sheet as needed for the project.

The standard symbols used for amendments (a triangular box) or contract modifications (a type of circular box, see the chapter on Drafting Criteria) shall not be used for any other purpose, and care must be taken to avoid using similar appearing but technically different symbols.

3.1.11 Key Plans

Provide key plans whenever the site or floor plan occupies more than one sheet of drawings. Locate the Key Plans at a uniform location on all site and floor and roof plan sheets to show the interrelationship between the building portions. Orient key plans in the same direction as the floor plan on all plan type drawings of all disciplines. All key plans shall be the same size and same location on the drawings.

3.1.12 Building Composite Plans

When required because of size of the building footprint, provide composite floor plans for the architectural, structural, mechanical, fire protection, life safety, and electrical disciplines. Include match lines for combining individual portions of floor plans. For mechanical plans, provide composite plumbing and heating, air conditioning, and ventilation (HVAC) plans showing plumbing and HVAC systems for each level. For plumbing composite sheets, building outline and pertinent HVAC equipment shall be half-toned with plumbing system at standard lineweight. For HVAC composite sheets, building outline and pertinent plumbing equipment shall be half-toned with HVAC equipment at standard lineweight. Do not provide construction notes on these plans. Include a key plan and room schedule legend on the composite plan sheets.

3.1.13 Schedules

Schedules shall be clear and complete. Furnish as many columns as necessary to present the essential information. Do not use the "Remarks" column as a substitute for an information column. Normally a single item shall be presented on each schedule line. Other scheduling methods as standard with the Architect-Engineer may be used if approved by written authorization from the Contracting Officer.

3.1.14 Notes

Notes may be placed on drawings to reduce the amount of repetitive drafting, provided that clarity is not lost. General notes should be placed at the right-hand edge of the sheet and, if possible, should be located on the first sheet in the set. Notes that pertain to each drawing should be placed on each drawing. Keyed notes are permitted. General notes may be provided on a separate sheet if space does not exist on the Abbreviation and Legend sheets.

3.1.15 Dimensions

Dimensions shall be complete, accurate, and fully coordinated. Use slashes, not arrowheads or dots. Dimensions should be to points easily measurable in the construction, and shall be laid so as not to eliminate refiguring in the field. Dimensions should be tied-in to column lines, etc., to facilitate checking. Plan dimensions for frame construction should be to face of stud (or sheathing) for exterior walls, to one face of stud for interior partitions, and to centerline of openings. For masonry construction, dimensions shall be to one or both nominal faces of masonry and to jambs of openings.

a. Horizontal dimensions shall occur on the plans and vertical dimensions on sections and elevations.

3.1.16 Standard Drawings

Standard Drawings, when furnished for site adaptation, will generally be utilized without basic architectural change. Portions of the drawings not pertinent to the project will be deleted. Specific instructions will be given when design changes are required.

3.1.17 Sketches

All sketches presented during the design phase shall be reduced to 216 mm by 280 mm (8-1/2" by 11") and included in the design analysis to document the design options and decisions evaluated during the design process.

3.2 CONSTRUCTION SPECIFICATIONS

3.2.1 Editing Construction Specifications

The Contractor shall use commercially available guide specifications for developing construction specifications, such as "SpecText" published by The Construction Specifications Institute (http://csi.worldweb.net/technic/master/spectextms.htm), and "MasterSpec" published by The American Institute of Architects (http://www.arcomnet.com/), or BSD SpecLink (Building Systems Design, Inc., Atlanta, GA, http://csi.worldweb.net/technic/master/bsdms.htm and http://www.bsdsoftlink.com/speclink/sl_frame.htm). Specification paragraphs and subparagraphs shall not be rewritten to lessen the quality of the original guide specification sections. Only bracketed choices and inapplicable items may be deleted unless the changes are required to bring the specification into conformance with the performance specifications of the Contract. The Contractor shall complete the editing of all options in these specifications. Where designer notes are provided, the Contractor shall edit the choice in accordance with the recommendations and guidance of the Notes. **The specifications shall clearly identify, where appropriate, the specific products chosen to meet the requirements of the Contract (manufacturers' brand names and model numbers or similar product information). The Contractor shall be responsible for coordinating references, along with the Contract performance requirements, to specific specification sections (number and title) within the construction specifications.** See additional requirements in paragraphs DESIGN DEVELOPMENT (60 PERCENT DESIGN REQUIREMENTS) and CONSTRUCTION DRAWINGS (100 PERCENT DESIGN) REQUIREMENTS of this Section and in Section 01015 DESIGN REQUIREMENTS AFTER AWARD, paragraph DESIGN DOCUMENTS.

3.2.1.1 Required Modifications to Commercial Guide Specifications

a. Indicate the guide specification series (e.g. CSI SpecText, MasterSpec, SpecLink) in either the header or footer of each section.

b. Change references to the "Architect" or "Engineer" to "Contracting Officer" and "Owner" to "Government".

c. Change references to "Section 01300" or "Section 01300 SUBMITTALS" to "Section 01330 CONSTUCTION SUBMITTAL PROCEDURES."

3.2.1.2 Additions

If the Construction Specifications do not cover a feature that is in the project, insert additional requirements in their proper locations to adequately cover the feature of work. Additions shall not lessen the quality of materials indicated by the specifications. If a new material is added, it shall be properly referenced in "REFERENCES," "MANUFACTURERS," "MANUFACTURED UNITS," "MATERIALS," "SUBMITTALS," "TESTS," and "INSTALLATION" paragraphs, as applicable.

3.2.1.3 Deletion of Inapplicable Text Material

Delete all inapplicable text material to tailor the specifications to fit the project. After deletion has been made of all inapplicable paragraphs, subparagraphs, choices, and schedules from the body of the guide specifications (including but not limited to the correction of lists in "SUBMITTALS," "TESTS," and "INSTALLATION" paragraphs), delete all nonapplicable references listed in the preceding "REFERENCES" and "MATERIALS" paragraphs.

3.2.1.4 References to Specification Sections

The Contractor shall be responsible for coordinating references, along with the Contract requirements, to specific specification sections (number and title) within the project specifications. Revise section references (title and number) to reflect the titles and numbers of specification sections used.

3.2.1.5 Construction Submittals

The Contractor is responsible for all submittals. See Section 01330 CONSTRUCTION SUBMITTAL PROCEDURES for the definition of Government Approved and For Information Only (FIO) submittals. All submittals shall be "FI0" unless otherwise specified. Submittals noted in the UFGS guides as "G" shall be changed to "For Information Only".

3.2.2 Division 1 Sections

Include Division 1 specifications sections contained in this Contract as part of the project specifications without change.

3.2.3 Format For Construction Specifications

Submit the construction specifications, including cover page and project table of contents, printed with a word processor.

The Lighting Fixture Standard Drawing 40-06-04 Details, and Design Criteria (e.g. Army Technical Manuals (TM's), Engineering Manuals, Engineering Technical Letters, Engineer Circulars, Engineer Pamphlets, Design Guides, and Military Handbooks) can be downloaded from the Internet at the

following address:

http://www.hnd.usace.army.mil/Techinfo/Engineer Publications or Support Documents

The guides can only be downloaded in Winzip *.zip files. These are downloadable executable files.

Specsintact software, the UFGS guide specifications, and design criteria manuals can also be obtained from the current version of the Construction Criteria Base CD, issued by the National Institute of Building Sciences, telephone number 202/289-7800, fax number 202-289-1092, internet address is:

http://www.nibs.org.

Fort Worth District guide specifications and the District supplements to the UFGS guide specifications are located on the Internet at the following address:

http://www.swf.usace.army.mil/links/e&c/ec-a/

Print hard copies using laser printer and good quality white paper. For the design submittals, editing of the Construction Specifications shall be shown by using redlining (underlined text) for text insertions and strikeouts for text deletions. The corrected 100 percent specifications with review comments incorporated shall be cleaned up (markings for insertion and deletions removed) and submitted in both hard copy and on CD-ROM disk. Carbon copies are not acceptable.

3.2.3.1 Format

Format shall be the Construction Specification Institute (CSI) 16-Division, 3-Part Section **(AM#5)** _____. Sections **(AM#5)** _____shall be numbered in accordance with CSI MasterFormat. No two sections shall have the same section number.

3.2.4.2 Cover Page

The Cover page shall be similar to the Contract Cover page and shall include:

a. Project title, activity and location

b. Construction contract number

c. Construction Contractor's name and address

d. Design firm's name and address

e. Names of design team members responsible for each Contractor prepared technical discipline of the project specification

f. Name and signature of a Principal of the design firm

g. The Table of Contents shall list the 16 Divisions contained in CSI format and the specification section numbers and titles contained in the project specification. Do not list in the Table of Contents CSI Divisions that are not required for the project.

3.2.4 Construction Submittals

All construction submittals shall be in accordance with Section 01330, "CONSTRUCTION SUBMITTAL PROCEDURES."

3.2.5 Submittal Register

An electronic version of the ENG Form 4288 is located on the Solicitation and Contract Award CD-ROM disks in folder "Subreg." This version is the Specsintact DOS Submittal Register program and includes a Readme.txt file. Copy the files to the computer's C:\ drive, remove the read-only attributes, and then double-click on either file "subreg.exe" or on "submit.bat." This is **not** a Windows-based program so the mouse **does not** work. Editing instructions are on-screen, such as press the "F5 (add)" and then the "E" keys to create new empty submittals, the "PgDn" key to complete editing, and the "A" key to accept. For each submittal, fill in the Section Number, Activity Number if applicable, Paragraph Number, Description, Type of Submittal (e.g. SD-01 through SD-11(See Section 01330 CONSTRUCTION SUBMITTAL PROCEDURES)), Classification (e.g. G or FIO), and the Contractor's proposed submittal date. Fill in columns "a" through "o" on the ENG Form 4288 and submit a copy of the "Subreg" folder with the updated files and a hard copy of the register as required for the various design submittals. Unless Section 01330 CONSTRUCTION SUBMITTAL PROCEDURES allows a submittal to be Government approved ("G"), all submittals shall be "FIO" for Information Only (Contractor Approved) items. A blank MS Excel version of the Form 4288 Submittal Register is also included in the "Subreg" folder and may be used if allowed by the Contracting Officer.

3.3 DESIGN ANALYSES

Prepare design analyses (basis of design and calculations) for each design discipline. Specific requirements relative to the technical content to be provided are specified in the paragraphs DESIGN DEVELOPMENT (60 PERCENT PRELIMINARY DESIGN) REQUIREMENTS and CONSTRUCTION DRAWINGS (100 PERCENT DESIGN) REQUIREMENTS. The design analyses shall be a presentation of facts to demonstrate that the concept of the project is fully understood and that the design is based on sound engineering. The design analysis for each discipline shall be in accordance with Chapter IX of the SWD-AEIM.

3.4 COMMON DESIGN DEFICIENCIES

The work involved in making corrections due to common deficiencies becomes lost effort and time for both the designer and the reviewer. Carefully compare the design and contract documents with all requirements at several points in the design process to avoid unnecessary changes at a later date. Some of the requirements which are most often overlooked include:

a. Requirements of the COE 2, Southwestern Division's ARCHITECTURAL AND ENGINEERING INSTRUCTIONS MANUAL (SWD-AEIM) have been repeatedly overlooked in the past.

b. Not used.

c. Not using correct abbreviations or terminology on the drawings. Abbreviations must match what is used on the standard abbreviation sheet and terminology must match what is used in the standard technical guide specifications.

d. Not using the correct scales, north arrow designation, section cut system, or incomplete dimensioning on the drawings.

e. Not providing sufficient space for door operation hardware at doors which swing into a wall running perpendicular to the opening. 100 mm minimum is required between edge of door frame and perpendicular walls.

f. Not providing correct and complete Design Analysis information written in the present tense. The Design Analysis will be written following the format indicated herein. A separate Fire Protection section in the Design Analysis with input from all disciplines is one area which is often overlooked and shall be included.

g. Not correctly presenting or coordinating (to avoid interference) features of Fire Protection, Noise Control, and Physical Security.

h. Not correctly referencing and cross referencing building sections, wall sections, details, etc.

i. Failure to read and use technical notes in editing the Guide Specifications.

j. Failure to coordinate all disciplines prior to submittal of projects for review.

k. Improper use of fire-retardant wood. Fire-retardant wood is combustible; its use in buildings that are of noncombustible construction is extremely limited (see UBC for the minor allowable uses). Because of the potential for severe degradation, fire retardant plywood shall not be used in a roof or roofing system, or in structural applications.

l. Incorrectly listing trade names in door hardware specifications in lieu of ANSI numbers and failure to correctly specify hardware finishes.
m. Control joints in CMU walls and brick expansion joints in face brick are not shown on both architectural plans, elevations and structural plans, or are inconsistent. Note also control joint locating and coordination for floor tile per Tile Council of America recommendations.

n. Failure to delete all publications which do not apply to the particular project.

o. North is not oriented the same direction on all sheets (civil, site, arch).

3.5 DESIGN CERTIFICATION

The Contractor shall provide certification for each design submittal in accordance with paragraph SUBMISSION OF CONSTRUCTION DRAWINGS, SPECIFICATIONS AND DESIGN ANALYSES, subparagraph "Certifications," of Section 01015 DESIGN REQUIREMENTS AFTER AWARD.

3.6 DESIGN DEVELOPMENT (60 PERCENT PRELIMINARY DESIGN) REQUIREMENTS

Preliminary design documents shall include all applicable plans, details, and specifications specified in the paragraph DESIGN DETAILS, drawn to 60 percent completion or more, unless otherwise indicated. The documents shall include all design and items required to be 100 percent complete. Identify and resolve conflicts in the design requirements, between the design requirements and the Contractor's design proposal, or those due to lack of thorough understanding of the nature and scope of work prior to submittal of the 60 percent design. Drawings, design analysis, and specifications will be reviewed for compliance with the Contract design requirements at this design submittal. Submit the following:

3.6.1 Rendering

The Contractor shall prepare an architectural rendering for inclusion with the 60 percent Design Submittal. The rendering will be in full color, represent the final exterior color and material selections, approximately 500 mm by 600 mm in size, on illustration board, matted and framed with non-glare glass, and with project title on mat. The perspective shall be from an eye-level or low-level aerial point of view that will highlight the most attractive features of the project. The Contractor shall furnish one preliminary black-and-white sketch of the proposed rendering to the Contracting Officer, along with three (3) proposed exterior color schemes, for review and acceptance prior to proceeding with the color version.

3.6.2 Drawings

Furnish all drawings that are required for the 100 percent submittal. Except for site work, outside utilities, and building foundation drawings, all drawings shall be developed to approximately 60 percent completion. Site work, outside utilities, and building foundation drawings shall be 100 percent complete. The drawings shall be fully coordinated with the design analysis and specifications.

3.6.3 Specifications

Provide all specification sections required for 100 percent submittal. Specifications for site work, and utilities, and foundation (Division 2 and those applicable in the other Divisions) shall be 100 percent complete. All other specifications required for the completion of the building, turfing, and landscaping shall be at least mark-ups of the required technical and trade sections. Include the identification of the "author" of the industry guide specifications used, any mandatory guide specifications required in this Contract, and a project table of contents listing all sections to be included in the project.

3.6.4 Submittal Register

Prepare a Submittal Register as specified in Section 01330 CONSTRUCTION SUBMITTAL PROCEDURES and paragraph CONSTRUCTION SPECIFICATIONS, subparagraph "Submittal Register," of this Section. Submittals for site work, utilities, and building structure shall be 100 percent complete. Submittals for all other work shall be developed to the extent required to support the level of design included in this submittal. Submit a copy of the "Subreg" folder with the updated files and program and four hard copies of the register with this design submittal.

3.6.4 Design Analysis

The design analysis shall give the basis for design for all disciplines and should establish specific goals, objectives, and priorities for the design of this project. Identify, explain, and document use of design criteria and how the design meets goals, objectives, and priorities. The design analysis shall comply with SWD-AEIM, Chapter IX, and include narrative description and analysis of all building systems, appropriate checklists, calculations, and catalog cut sheets of equipment used in the design.

3.6.5 **Sustainable Design (AM#2) (AM#6)**

Using the Sustainable Project Rating Tool (SPiRiT), Version 1.4, provide a self-assessment of the achievement to-date of the sustainability features of the facility (see Volume IV ATTACHMENTS for the Sustainable Project Rating Tool manual and rating sheets). Use the SPiRiT tool (SPiRiT v.1.4 Final.doc) for documentation.) available on the Internet at http://www.cecer.army.mil/Sustdesign/SPiRiT.cfm, or use the version that is on the Contract CD. Summarize the scoring on the SPiRiT scoring sheet (SPiRiT v.1.4 Final Summary Sheets.xls)) which is available at http://www.cecer.army.mil/Sustdesign/SPiRiT.cfm (this file is also located on the Contract CD). This scoring summary shall be attached to the front of the SPiRiT tool in the submitted documentation. Goal is minimum Bronze level certification. If Bronze level certification cannot be attained, discuss the factors that prevent achievement of this goal. (AM#6)

3.6.6 Civil Design

The drawings shall be 100 percent complete, ready for start of construction. Drawings shall fully describe the type and the scope of work required. Include all necessary and required details, be thoroughly checked, and be fully coordinated with the Construction Specifications and all other Construction Documents.

3.6.7 Landscaping Design

Provide Landscaping Plan, and any details required for this level of design.

3.6.8 Architectural Design

60 percent architectural drawing submittal shall be a complete set of architectural drawings without large scale details. All other drawings shall be complete except referencing of the large scale details. Room finish schedule, and door, window, and louver schedules, shall all be complete except for references to details.

3.6.9 Interior Design

Provide SID Notebook(s) and design analysis.

3.6.10 Structural Design

Provide details and notes for required structural work. Building structural members shall be at least outlined. Provide elevation views, sections, and details necessary to illustrate the design at a 60 percent level of completion. Roof framing plan(s) shall show sufficient details to clearly indicate the type of framing system used, size, and spacing of members and their elevations.

3.6.11 Mechanical Design

Provide plans, piping diagrams, sections, flow diagrams, details, schedules, and control diagrams/sequences as necessary to define the required design intent at this level of design. Floor plans shall use the architectural floor plans as a basis, with the building outline half-toned. Unless otherwise indicated, all floor plans shall be drawn at a minimum 1:500 (1/4-inch = 1'-0") scale and shall show room names and numbers. Provide preliminary mechanical room sections to ensure that major equipment items, piping, and ductwork will fit as designed. For the 60 percent submittal, all supply and return mains shall be shown as double-lined although branch ducts, takeoffs, and ductwork to diffusers may be single-lined. Piping 6 inches and larger shall be shown as double-lined for the 60 percent submittals.

Complete Attachment C for mechanical room sizing.

3.6.12 Electrical Design

Fully coordinate the 60 percent design drawings with the design analysis. Provide sufficient plans, single-line diagrams, riser diagrams, details, and schedules as necessary to define the required design intent for this level of design. Indicate all circuits, circuit breakers or fuse locations, panelboards, and PDUs known at this level of design.

3.6.13 Fire Protection Design

Provide the Life Safety Plan complete. Fire protection details shall be sufficient for this level of design.

3.6.14 Environmental Design

Provide drafts of the following items for the Preliminary(60 percent design) submittal:

a. Environmental Survey Sampling Plan (if applicable)

b. Stormwater Pollution Prevention Plan (SWPPP)

c. Plans for SWPPPP shall include Erosion and Sediment Control Plans, Erosion and Sediment Control Structures and Details, Project Location and Vicinity Map as a separate and stand-alone drawing set.

d. Design Analysis provides for the preliminary design and final design submittal. It shall address environmental issue and considerations for the project during programming stage and design features. Discussion shall at least include the following:

1.0 APPLICABLE REFERENCES

2.0 CULTURAL AND NATURAL RESOURCES
2.1 National Environmental Policy Act Compliance Document (Include Type of document and completion date)
2.2 Protection of Historic Properties & Guidance
2.3 Protection of Cultural Properties & Guidance
2.4 Protection of Threatened and Endangered Species and Critical Habitats & Guidance
2.5 Wetland and Floodplains & Guidance

3.0 WATER QUALITY AND PREVENTION OF WATER POLLUTION

3.1 Water Supply & Guidance
3.2 Municipal Wasterwater & Guidance
3.3 Industrial Wastewater & Guidance
3.4 Storm Water & Guidance (design & construction to prepare and **Reference Section (AM#2)** 01421 Outline of Storm Water Pollution Prevention Plan)

4.0 AIR QUALITY AND PREVENTION OF AIR POLLUTION
Design Issues & Guidance (Design Features & construction document to be prepared, indoor radon reduction and mitigation design requirements)

5.0 SOLID WASTE
5.1 Design Issues & Guidance

6.0 HAZARDOUS, TOXIC, AND RADIOLOGICAL WASTE (HTRW) (one sub-paragraph for each issue & construction document to be prepared)

7.0 FEDERAL, STATE AND LOCAL PERMITS, LICENSES, NOTIFICATIONS, PRE-CONSTRUCTION PERMITS AND REGISTRATION (reference 01355 ENVIRONMENTAL PROTECTION, and indicate coordination with **Base Directorate of Environment (AM#2))**

3.7 CONSTRUCTION DOCUMENTS (100 PERCENT DESIGN) REQUIREMENTS

All documents shall be 100 percent complete, ready for start of construction.

3.7.1 Drawings

The drawings shall be complete, ready for start of construction, and include all necessary and required details, be thoroughly checked, and fully coordinated with the construction specifications and all other Construction Documents. The final drawings shall include all the requirements and drawings defined for the 60 percent submittal plus any additional detail drawings required for complete 100% design. **(AM#2).** Plans shall be legible at full-size. Previous comments and applicable criteria changes shall have been incorporated into the design.

3.7.2 Submittal Register

Prepare a complete a Submittal Register using ENG Form 4288 "Submittal Register" as specified in Section 01330 CONSTRUCTION SUBMITTAL PROCEDURES and paragraph CONSTRUCTION SPECIFICATIONS, subparagraph "Submittal Register," of this Section, listing submittals for all specification sections that require submittals. Submit four hard copies and on a CD-ROM disk the updated submittal register files and program for this design submittal and the final submittal.

3.7.3 Specifications

The construction specifications shall be complete, ready for start of construction, fully coordinated with the drawings and design analysis, and include all work. Specifications shall be in final form for construction and include all changes requested during the 60 percent review stage.

3.7.4 Design Analysis

The Design Analysis shall include the basic information presented in the previous submittal, corrected to reflect changes in content made in response to review comments. Outline specifications shall be omitted from the Final Design Analysis as the information is included on the final drawings and construction specifications. The design analysis shall be written in the present tense and will comply with SWD-AEIM, Chapter IX.

3.7.5 **Sustainable Design (AM#2) (AM#6)**

Update the Contractor's Sustainable Project Rating Tool (SPiRiT) sheets indicating the status of design related to the listed elements and the achievement of the specified rating. Provide letter certifying the achievement of the specified rating. (AM#6)

3.7.6 Interior Design

Update the drawings, building related interior design (SID), and the SID Notebooks as required as a result of the 60 percent review.

3.7.7 Mechanical Design

All ductwork shall be double-lined. Piping 6 inches and larger shall be shown as double-lined.

3.8 DESIGN DETAILS

Drawings shall include the applicable plans, details, and requirements specified in the SWD-AEIM and those specified below.

3.8.1 Demolition

Show new work and demolition work on separate drawings. The type and the scope of removal work intended shall be clear from an inspection of the documents. Keyed notes for removal will be allowed.

a. Site Demolition Drawings (Removal Plan)

The removal plan shall show the existing physical features and condition of the site before construction. Include the field survey to show all above and below ground utilities; buildings, drives, roads and parking areas, walks, and vegetation; and such facilities as retaining walls, underground storage tanks, foundations, and existing contours. Physical features shall be indicated and noted: to be removed, to remain, or to be relocated.

3.8.2 Civil Design

The drawings shall be complete, fully describing the type and the scope of work required. Include all necessary and required details, thoroughly checked, and fully coordinated with the Construction Specifications and all other Construction Documents. Include the following as applicable:

Cover Sheet and index of drawings
Location and vicinity map including haul routes
Site plan and details
Grading and drainage plan
Utility plan with profiles and details
Pavement plan and details

Soils boring logs
Landscaping plans and details

a. Location Plan and Vicinity Map

A Vicinity Map consists of a small scale drawing of the project location, similar to a road map. A Location Plan consists of a small scale drawing showing the Government property or reservation limit with the construction project site shown. Show the Contracting Officer-approved Contractor access and haul routes, load limits on bridges along haul routes, and the designated waste and/or borrow areas. Upon request, a reproducible base sheet will be provided by the Fort Worth District for the Contractor's use in preparing the Location Plan.

b. Site Plan

Show all the site layout information necessary to field locate the building, walks, parking lots, and all other appurtenances to be constructed for the project. All site related work to be constructed will be located by dimensions. Identify all site related items such as curbs, pavements, walks, courtyards, bollards, trash enclosures, and retaining walls. Unless otherwise specified, site plans shall be at a scale of 1:400, 1:500, or 1:600 (1" = 20' or 1" = 30'). Existing or proposed contours shall not be shown on this Plan. The Site Plan, prior to adding the dimensions, shall serve as the base sheet to the other Plans, such as the Utilities Plan, Grading and Drainage Plans and the Landscape Plan. The Site Plan will show all existing physical features and utilities within and adjacent to the work site that will remain after the proposed construction has been completed. Include free zones, construction limits, storage areas, etc.

Show the building orientation and horizontal dimensional relationships to streets, walks, property lines, easements, fences, and other structures. Space between structures will provide open areas in accordance with good land-use planning and due consideration of future development plans. Maintain fire clearance separations for access for equipment acceptable to the installation (i.e. Installation Fire Chief). Show geometric features of all roads, streets, sidewalks and parking areas. Provide details of all site features.

c. Grading and Drainage Plan

Provide a preliminary grading and drainage plan at a scale of 1:400, 1:500, or 1:600 (1" = 20' or 1" = 30') unless otherwise specified. Indicate new and existing grading contours at 300 mm (1-foot) contour intervals. Provide spot elevations in sufficient numbers so that interpolation between contours is not required. Some examples are: corners of paved areas and parking lots, low points, high points, flow lines of ditches and swales, changes in degree of slope and grading at building corners to insure positive drainage from the facility.

Indicate finished floor elevation of new building(s). Finished floor elevations shall be a minimum of 300 mm (12 inches) above the highest point of the outside finished grade and slope away from the building. Grade contours shall be at 240 mm intervals and spot elevations shall be provided at all site development features.

Show layout of the new and existing storm drainage systems, if applicable, including existing and new storm drainage flows, ditches, swales and piped

systems.

Provide the appropriate top of structure elevations and pipe invert elevations of both the new and existing drainage system.

d. Erosion Control Plans

Erosion control plans shall show locations of all sediment basins, diversion ditches, areas to receive rock blanket, and other erosion control structures, indicating the approximate drainage areas each will serve. Indicate the materials, construction, and capacity of each structure.

e. Composite Utilities Plan With Profiles And Details

If required, provide a Composite Utilities Plan at a scale of 1:400, 1:500, or 1:600 (1" = 20' or 1" = 30'). Indicate locations of new and existing utilities. Plans shall show layout of the new and existing storm drainage, gas, sanitary sewer, fire protection, electrical, communication, water, steam, and any other utility systems which need to be provided for. Include new and existing contours. Show mains and distribution lines as well as all appurtenances such as meters, manholes, and valves.

f. Grading Sections

Grading sections through the new building showing finished and existing grades may be provided to supplement the required grading plan.

g. Pavement Plan and Details

Provide pavement plans for all parking lots, roads, equipment pads and sidewalks. Include cross sections of all paving designs and include details of curbs, gutters, pads, sidewalks, stairs, inlets and other features.

h. Soils Boring Logs

Provide logs of soil borings provided by the geotechnical engineer.

3.8.3 Landscaping

Provide a Landscape Plan showing trees, shrubs, ground covers, seeded and sodded areas. The Landscape Plan shall be prepared by a Licensed Landscape Architect. The landscape plan shall be in accordance with the Installation Design Guide and Fort Sam Houston Landscape Master Plan.. Select and specify types of plant materials that are locally grown, commercially available, and acclimated to the project environment. Include a plant materials schedule or listing which lists the botanical names, common names, key, size, and the method of transplanting for each landscape element. The landscape plan shall also show all unsurfaced ground areas disturbed by construction within the project limits with these areas shown to be seeded, sodded, or mulched as required. Include designs and details for required site furnishings and accessories.

The Contractor shall provide designs and details as necessary for required site furnishings and accessories.

3.8.4 Architectural Design

a. Floor Plans

Provide double line floor plan(s) of the entire building(s), drawn at the largest scale practicable to include the entire building or floor level on a single sheet. The building footprint may be of a size that will require the floor plans to be divided into multiple areas. Floor plans shall be scaled double-line drawings showing the functional arrangement, structural column or bay indicators, material patterns, location of all openings and plumbing fixtures. Section cuts, wall types, notes and leaders, general notes, and dimensions shall be complete. The plans shall indicate room numbers and titles, door swings, door and window numbers and types. Provide door, window, louver, and other schedules as required. Show a north arrow on each floor plan. Include enlarged toilet room and stair plans. The first floor plan sheet shall include a gross area tabulation comparing the actual square footage with the authorized square footage of the facility. Fully justify architect-engineer suggestions for plan improvement. Include:

Overall, Control, Opening, and complete dimensioning
Room Names and Numbers
Wall and Building section cuts
Door Swings and Numbers
Window Types
Square Footage
General Notes

Where major structural elements are included as parts of architectural detailing, do not indicate sizes. Define these elements as part of the structural design documents. Major elements of mechanical and electrical equipment affecting space allocation shall be shown on the architectural plan to the extent practicable and coordinated with other respective disciplines. When applicable, Government-furnished and Contractor-installed, or Government-furnished and installed, items shall be shown as dashed lines.

b. Reflected Ceiling Plans

Reflected ceiling plans shall include all notes, complete legends and pocheing patterns of materials to be used. Provide reflected Ceiling Plans for all spaces in the building(s). Reflected ceiling plans shall show the ceiling tile layout and location of gypsum wallboard and other ceiling types where applicable. Show all light fixtures, air diffusers, grilles, registers, exit lights, public address speakers, fire alarm strobe lights, sprinkler head layout, ceiling mounted equipment access panels or removable ceiling tile and grid elements, smoke and heat detectors, wall fire ratings, ceiling mounted equipment removal pathways, ceiling mounted television mounts, and other ceiling mounted items. The fixtures and other equipment shall be laid out in a regular pattern symmetrical with the ceiling tile grid, or symmetrical with the room centerlines, columns, windows, or other feature that dominates. All ceiling mounted items shown shall be fully coordinated with all other disciplines.

c. Roof Plan

Roof plan shall be complete showing slopes, locations for roof and overflow drains, equipment, and walkways. Coordinate elements located on the roof with all disciplines.

d. Building Elevations

Provide all building elevations complete showing the appearance and architectural treatment. Elevations shall be dimensioned to show story height, total height and relation to grade. Indicate critical elevations such as top of finish floor and top of steel.

e. Building Sections

Include building cross section and longitudinal sections to show general interior volumes, framing method, relationship to adjacent structures, and height of ceilings and partitions. Identify materials used and necessary dimensions.

f. Wall Sections

Drawings shall include all wall section [and stair section] conditions [including enclosed corridor(s) showing vertical control elevations] and dimensions. Label all materials. Cut sections should through doors, windows, and other critical wall section locations. Wall sections shall not be broken. Include additional details when necessary to illustrate abutting adjacent buildings and important or unusual features. All horizontal dimensions shall occur on the plans and vertical dimensions on the sections and elevations.

g. Room Finish Schedules

Include signage.

h. Door, Window, and Louver Schedules

Door schedule shall include door and frame types and references to door details and hardware sets. Window and louver schedules shall indicate window and louver types, sizes, and references to details.

i. Fire Ratings

Clearly indicate wall ratings and fire hazards as required by the National Fire Protection Association Codes (NFPA). See Military Handbook MIL HDBK 1008C, particularly Section 2.1 Basic Criteria and Section 2.1.2 Partitions. In addition to the wall rating criteria required by the Codes, provide a minimum of one-hour rated wall assembly around all Janitors Closets, Store Rooms, Mechanical and Electrical Rooms or Closets. Wall fire ratings shall be graphically shown by a continuous symbol or pattern within the wall on the reflected ceiling plan and/or on a Fire Protection/Life Safety Plan. When other functions coexist with the fire protection functions, their integration shall be clearly indicated with an analysis that describes how both functions will be served. Provide a separate, composite type floor plan which makes an accurate presentation of these various features and functions. By authorized written permission, where the building and features being shown are unusually simple, this information may be included on other drawings. Rated wall details shall include the design number of the testing laboratory certifying the rating.

j. Modular Design

Use modular design practices for the design of all masonry buildings or components of buildings. Dimensions shall be figured to whole or half-unit lengths (in increments of 100 mm) in order to reduce on-site cutting of masonry. Units less than 102 mm long shall be avoided.

k. Room and Door Numbering

The Room and Door Numbering system shall be consistent for all buildings designed under any one contract. Room numbering shall start at the main entrance and proceed clockwise around functional areas.

l. Facility Elevation

The elevation of the first floor shall be indicated as 100 000 mm (100 feet) and shall be a minimum of 300 mm above finish grade. Elevation for other floors, footings, etc., shall be related to this figure. Sea level elevations shall not be shown on the building drawings. Show elevations of the first floor above sea level on the grading plan (Civil).

m. Access to Utilities

All utilities within the building, such as piping, ductwork, and electrical work, shall be concealed in finished areas unless otherwise specified in the Program and Performance Requirements. Provide plumbing chases in toilet areas. Carefully figure the clear space above ceilings and the size of chases to accommodate piping slopes and connections, ductwork crossovers, and fittings, HVAC piping and valve service spaces, and similar situations. Provide access to valves, cleanouts, etc. Space provided for utilities systems shall be adequate but not excessive.

3.8.5 Interior Design

Furnish Building Related Interior Design (SID) Package, including floor plans, finish and color schedules, interior design analysis, and sample/color boards, in accordance with SWD-AEIM, Chapter III, paragraph "Interior Design." SID refers to the building related exterior and interior finishes. On the floor plan(s), show furnishings that are not considered part of the Contract, such as Government-furnished, Government-installed items, by the use of dashed lines and designated as "Not-In-Contract" (NIC). Use the design analysis to explain the desired image or visual appearance of the interior of the facility.

3.8.5.1 Submittal Requirements for SID Notebooks (Color/Finish Sample Boards)

a. Furnish 4 sets of color/finish board(s) with attached samples of the proposed building-related finish materials mounted on 215 mm by 280 mm by 1.5 mm (8-1/2 inch by 11 inch by 1/16 inch) thick mat board in three-ring notebooks. Epoxy glue, hot-melt glue, or contact cement shall be used to attach samples; Scotch tape, double-backed tape, or rubber cement will not be acceptable. Heavy samples shall be mechanically fastened. Photographs or colored photocopies are acceptable only for illustrating furniture, furnishings, and art work; not for material and color samples.

b. The notebooks shall be labeled on the outside spine and front cover with the phase percentage, SID, project title and location, Contract number, date, and the Contractor's name and address.

c. Sequence and Content of SID Submittal

The sequence and content of SID Submittals shall be as follows:

(1) Title Page.

(2) Table of Contents.

(3) Narrative of Interior Design Objectives.

(4) Exterior Elevation Drawing.

(5) Exterior Building Material Legend.

(6) Exterior Building Material Color Board(s).

(7) Room Finish Schedules.

(8) Interior Color Placement Plan.

(9) Interior Color Boards (according to color placement plan).

Each sample shall indicate color, texture, and finish; and, if patterned, shall be large enough to define full pattern. Samples shall be identified as to type of material, area of installation, manufacturer, and transmittal number under which certification of the material represented will be submitted in accordance with the requirements of Section 01330 CONSTRUCTION SUBMITTAL PROCEDURES.

(10) Interior Floor Plan(s) And Furniture Layout, including an index keyed to the furniture, furnishings, and art work illustration sheets..

(11) Signage Location Plans(s).

(12) Interior Signage Color Boards.

(13) Not Used.

(14) Not Used.

(15) Not Used.

3.8.6 Structural Design

Drawings shall include foundation plans and details, floor framing plans for each floor when applicable, floor slab plans, and roof framing plans.

a. Show the location of all in-wall columns or pilasters.

b. Foundation and slab plans shall show the size and location of all foundation elements, such as foundation walls, grade beams and footings. Elevations for footings shall be indicated on the plan. Plans for slabs-on-grade and exterior stoop slabs at building entrances shall show location and type of joints, slab thicknesses and reinforcing, elevation of slab surfaces, and any other design features, such as equipment bases, heavy Lab equipments, isolated foundations and the in-slab electrical raceway, which affect the slab design.

c. The sizes, locations, and elevations of footings shall be shown.

d. Coordinate slab plans with the Electrical sheets and indicate the locations of in-slab electrical raceway trench ducts or similar items.

e. Show concrete slab-on-grade thicknesses and sections.

f. Show proposed treatment of special foundations and other unique or complex features and details.

g. Provide elevation views, sections, and details necessary to illustrate the design.

h. Roof framing plans shall show sufficient details to clearly indicate the type of framing system used, size, and spacing of members and their elevations.

i. Drawings shall include overall building plan dimensions, north arrows, and design notes.

j. Grid Systems, Dimensions, and Floor Elevations

Each foundation and slab plan and roof framing plan shall have an alpha-numeric grid system aligned with any in-wall columns or pilasters, or with load bearing and non-load bearing walls, as applicable. The same grid system shall be used for all plan views. Each plan view shown shall have all necessary dimensions. On plan views, the dimensions shall define the location of grid lines, offsets, and all structural elements, as well as the overall sizes of the structure. The finish elevation of the floor slab shall be indicated as 100 000 mm (100 feet), and elevations for foundations, walls and roof members shall be referenced to this basic elevation.

k. Plan Sheets

(1) Foundation and Slab Plans

Foundation and slab plans shall show the size and location of all foundation elements, such as foundation walls, grade beams and footings. Elevations for footings shall be indicated on the plan. Plans for slabs-on-grade and exterior stoop slabs at building entrances shall show location and type of joints, slab thicknesses and reinforcing, elevation of slab surfaces, and any other design features, such as equipment bases, heavy Lab equipments, isolated foundations and the in-slab electrical raceway, which affect the slab design.

(2) Roof Framing Plans

Roof framing plans shall be provided for all parts of the structure. Plans shall show the size, spacing, and location of all roof framing members, their supporting in-wall columns, pilasters or walls, all auxiliary members such as bracing and bridging, and the size and location of all major openings through the roof. Plans shall show support system for satellite dishes.

l. Elevation Views, Sections and Details Sheets

Elevation views, sections, and details necessary to illustrate fully the design shall be provided. Some requirements peculiar to the various structural materials are described below.

(1) Concrete

Include elevation views as necessary, plus sections and details to show the outlines of concrete cross-sections, reinforcing bar arrangements, concrete cover for rebar, installation of embedded items, and joint construction. All lap splice and embedment lengths for reinforcing bars shall be clearly indicated on the drawings. A sill detail for each foundation condition at exterior and interior doors shall be provided.

(2) Masonry

Wall reinforcing shall be located and identified on plans, in section cuts, elevation views, or in schedules. When required, include structural elevations to clarify the construction requirements for masonry reinforcement, especially the reinforcement around wall openings. Listed below are some frequently required masonry details, most of which are shown in ICBO Bldg Code and SWD-AEIM. Details may be extracted from other sources and incorporated into the final drawings. Edit the details to reflect the specific requirements of this project.

(3) Structural Steel, Steel Joists, and Steel Decking

Structural steel connections shall be fully detailed and shown on the drawings. The anchorage of beams, trusses, joists, and steel deck to walls or other bearings, and the extra framing or reinforcement required at deck openings shall also be detailed. Notes, details, or schedules on the drawings shall indicate the steel deck attachment method to be used, and shall give the size and spacing for perimeter, side lap, intermediate supports and end lap attachments. Welded connections shall be detailed using standard weld symbols illustrated in AWS D1.1. All applicable weld sizes, spacing, types, contours, and finishes shall be shown.

(4) Cold-Formed Steel Studs

Cold-formed steel connections shall be fully detailed and shown on the drawings. The anchorage of studs to top and bottom runners, of top and bottom runners to supporting members, and the extra framing at openings shall also be detailed. Notes, details, or schedules on the drawings shall indicate the steel stud and runner dimensions, spacing, and attachments.

m. Schedules

(1) Foundation Schedules

Foundation schedules for footings or grade beams shall be included as applicable. The schedule shall include all pertinent information required for the foundation system being used.

(2) Framing Schedules

For concrete framing, beam, and column schedules shall conform to the requirements of the ACI SP-66. For structural steel framing, provide a column schedule complete with design loads at splices, if any, and at column bases, plus a tabulation of the loads, shears, moments and/or axial loads to be resisted by the beams and their connections.

n. Equipment Loads

All equipment loads which exceed 80 kg and are not supported by concrete slab-on-grade, shall be identified on the drawings by showing equipment locations, total weights, and reaction loads at support points.

o. Notes

(1) Design Notes

Under the heading "Designer's Notes," the structural drawings shall contain notes which begin:

"The structural design was prepared using the following data:".

The data then listed shall include the structural loading criteria used for design, such as roof and floor live loads, snow load design parameters, wind speed and wind load design parameters, seismic design parameters (Zone Z, I, Rw, C, and S values), allowable soil bearing pressures (as recommended by the foundation analysis), foundation design depth, design wind uplift pressures for steel joists and other data pertinent to future alterations. Also, to be listed are the ASTM designations and stress grades of the applicable structural materials: steel, masonry, concrete for each usage, reinforcing bars, and bolts.

(2) General Notes

Other notes, which direct the work to be performed, the materials to be used, etc., shall be grouped under the heading of "General Notes." Include in these notes a description of the building's structural system, if necessary.

3.8.7 Mechanical Design

Provide plans, piping diagrams and isometrics, mechanical room sections, water and air flow diagrams, details, schedules, control diagrams, sequence of operations, etc. as necessary to define the required design intent. Floor plans shall use the architectural floor plans as a basis, with the building outline half-toned. Large-scale plans of congested areas shall be provided. Coordinate with architectural design for provision of access panels for all concealed valves, traps and air vents, etc. Unless otherwise indicated, all floor plans shall be drawn at a minimum 1:50 (1/4 -inch = 1'-0") scale and shall show room names and numbers. Drawings shall include, but not limited to, the following:

a. Mechanical Abbreviation, Legend, and General Notes Sheet

This sheet shall include all mechanical abbreviations and symbols that will be used on the drawings. Include mechanical general installation notes that are required to clarify the construction intent that may not be readily apparent in the specifications or on the drawings. Symbols shall be grouped into sections; as a minimum, provide sections for Plumbing and HVAC. Control drawing symbols shall be shown on a separate drawing.

b. Plumbing Drawings

Plumbing Plans: Plumbing plans show show the design and layout of the domestic hot and cold water distribution systems; soil, waste and vent

piping. Include routing of piping systems from the connections within the structure to a point 1.5 meters (5 feet) outside the structure. The grade of all drain lines shall be calculated and invert elevations established. All plans shall show plumbing fixtures. All electrical panels and equipment and pertinent HVAC equipment shall be outlined in half-tone on the plumbing plans. Plans may be drawn at 1:50 (1/4 inch = 1 foot) scale as long as legibility is not compromised. Plumbing fixtures and drains shown on the drawings shall be designated by the same identification system used in the Construction Specification Plumbing Fixture Schedule. Include the following:

(1) Enlarged bath room plans showing all fixtures, water, waste, and vent piping for each toilet area.

(2) Plumbing water and waste/vent riser diagrams for each wet area. Provide plumbing water and waste/vent riser diagrams for each wet area.

(3) Plumbing details and schedules.

c. Mechanical HVAC Drawings, Details, and Schedules

Show on mechanical HVAC drawings, all items of mechanical equipment to clearly illustrate all HVAC system designs, and to determine proper space allocation within the intent of the architectural layout requirements. Plans and sections shall be developed sufficiently to ensure that major equipment items, piping, and ductwork cause no interference with structural members, electrical equipment, etc. Provide Schedules for each item of mechanical equipment. Provide installation details showing specification requirements such as isolation and balancing valves, equipment pads, strainers, vents, hangers, and vibration isolation for each item of mechanical equipment. Include enlarged equipment room floor plans showing the layout of all HVAC equipment, piping, and ducts located within the rooms and dedicated access space for items requiring maintenance; and drawn at a minimum 1:25 (1/2 inch = 1'-0") scale. Provide equipment room sections to show equipment and components, ductwork connections and routing, and relationship to adjacent structural features. The following HVAC drawings shall be provided:

Mechanical HVAC Plans: Mechanical HVAC plans shall show the design and layout of the refrigerant piping, condensate piping, ground coupled heat exchanger piping, desuperheater piping, air supply and distribution systems, and ventilation and exhaust systems. Air supply and distribution systems shall show all ductwork, including supply and return mains, branch ducts, and takeoffs; ductwork to diffusers; diffusers, grilles, and registers.

3.8.8 Electrical Design

Provide plans, single-line diagrams, details, and schedules as necessary to define the required design intent. Coordinate the electrical and communications design with the design for other disciplines. Floor plans shall use the architectural floor plans as a basis with the building outline half-toned. Unless otherwise indicated, all floor plans shall be drawn at a minimum 1:50 (1/4-inch = 1'-0")scale and shall show room names. Site plans shall use civil site plans as a basis with all none electrical and communication items half-toned. Scale shall match that used for the

grading plan. Include the following as applicable:

a. Electrical Abbreviations and Legends

b. Drawing Notes

c. One-Line Diagram

Detail the complete electrical system with a simplified one-line diagram. The diagram shall show ratings of major equipment including short circuit ratings. Use standard symbols for electrical equipment including, but not limited to, sectionalizing cabinets, transformers, and panel boards. Include circuit breaker ratings; transformer ratings and connection configuration; panelboard current and ampere interrupting current (AIC) ratings; raceway and conduit sizes and material type; and conductor and ground type, size, and insulation ratings.

d. Power Plan

Detail the electrical wiring for outlets, other than lighting. Identify rooms by name.

e. Lighting Plan

Detail the electrical wiring and switching for lighting. Identify rooms by name.

f. Lighting Fixture Schedule

g. Panelboard Schedules

Detail the circuits and circuit breakers in panelboards. Panelboard schedules shall include the designation, location, mounting (flush or surface), number of phases and wires, voltage, capacity and total connected and demand load. Indicate the trip rating, frame size, interrupting rating, and number of poles for each circuit breaker in the panelboards. List the circuit number, circuit description, and load for each branch circuit. Include estimated maximum demand for each panel.

h. Site Plan

Detail the connection of pad-mounted sectionalizing cabinets. Show underground electrical and communications cables. Show utilities the underground electrical and communications ducts will cross. Communications design will be obtained from Southwestern Bell. (AM#2)

i. Communications System

Detail the home run wiring and other **(AM#2)** equipment required to support cable television and telephone.

j. Grounding System

Show location and detail for grounding electrode; grounding conductor and bond materials, and sizes.

k. Miscellaneous Details

Provide **(AM#2)** electrical manhole details, special light fixture

details, etc.

3.8.9 Fire Protection Design

Provide plans, diagrams, sections, and details as necessary to define the required design intent. Floor plans shall use the architectural floor plans as a basis, with the building outline half-toned. Unless otherwise indicated, floor plans shall be drawn at a minimum 1:100 (1/8 inch = 1'-0") scale and shall show room names and numbers. Drawings shall include, but not limited to, the following:

Life Safety Plan

Show:

- location of fire separation walls, column, floor and roof protection,
- path of travel for emergency egress and panic exits,
- access to building for fire fighting,
- rated doors and windows,
- requirement for mechanical and electrical penetrations through fire separation walls and floors,
- placement of fire extinguishers, and
- occupancy types.

3.8.10 Environmental Design

Provide the following items and include response and annotated comments from preliminary design review for 100 % submittal:

Environmental Survey Sampling Plan for Abatement Items (if applicable)

Stormwater Pollution Prevention Control Plan

The Contractor shall submit for Government review and approval a project specific narrative or Detailed Storm Water Pollution Prevention Plan (SWPPP) or Erosion and Sediment control Plan developed in accordance with Section 01355 **ENVIRONMENTAL (AM#2)** PROTECTION, and Section 01421 OUTLINE OF A BASIC STORM WATER POLLUTION PREVENTION PLAN.

The Contractor shall also provide 2 final sets of corrected Erosion and Sediment Control Plans depicting types and location of control structures and provide Erosion and Sediment Control Structures and Details, Project Location and Vicinity Map as 1/2 size a stand-alone including 2 hard copies of SWPPP naratives.

Design Analysis

The Contractor shall reference above requirements for preliminary design submittal in 3.6.16 and prepare a Chapter in the Design Analysis entitled: "Environmental Protection Compliance". This Chapter shall summarize how the project complies with all environmental laws and regulations, and including signed pre-ocnstrcution permit or notifaction forms or the final permit as attachedment. As a minimum, the Chapter shall include the following:

a. The Permitting and/or Approving Authority(ies).

b. Construction/Operating Permits, Notices, Reviews and/or Approvals required. If, when checking with the agencies, a permit,

notice or approval is not required, include a copy of the telephone conversation memorandum or letter from the agency.

c. Time required by the permitting agency(ides) to process the application(s) and issue the permits.

d. Fee schedule including filing/application fees, review fees, emissions fees, certification testing, etc.

e. Monitoring and/or compliance testing requirements.

f. Actual Environmental regulations governing the applications, exemptions, variances, etc. or at a minimum a brief summary of the regulation and title.

3.9 **ATTACHMENTS**

Attachments A, B, and C follow this page.

3.9.1 **ATTACHMENT A**

CODE ANALYSIS

UNIFORM BUILDING CODE (UBC) AND NFPA "LIFE SAFETY CODE" ANALYSIS

LIFE SAFETY AND FIRE PROTECTION IS AN INTEGRAL PART OF EVERY FACILITY DESIGN. RECOGNIZED CODES AND ACCEPTED SAFETY STANDARDS SHALL BE FOLLOWED IN THE DESIGN OF ALL FACILITIES. OF THE VARIOUS CODES AND SAFETY STANDARDS THE NATIONAL FIRE PROTECTION ASSOC. (NFPA) "LIFE SAFETY CODE" SHALL TAKE PRECEDENCE. ALL APPLICABLE REQUIREMENTS OF THE LIFE SAFETY CODE SHALL BE INCORPORATED INTO EACH DESIGN. FOR TYPE OF CONSTRUCTION, FIRE AREA LIMITATIONS, AND ALLOWABLE BUILDING HEIGHTS THE DESIGN SHALL FOLLOW THE UNIFORM BUILDING CODE (UBC).

CHECK LIST

PROJECT NAME _____ DATE_____

LOCATION _____

3.9.1.1 UNIFORM BUILDING CODE ANALYSIS

a. OCCUPANCY CLASSIFICATION (See Table 5A):

Area:	Classification:
(GROUP: _____):	Div. _____
(GROUP: _____):	Div. _____
(GROUP: _____):	Div. _____

PRINCIPAL OCCUPANCY _____

OTHERS (SPECIFY) _____
_____
_____
_____

b. TYPE OF CONSTRUCTION :

_____

c. OCCUPANCY SEPERATION REQUIRED (SEE TABLE 5-B):

_____ TO _____ = _____ HRS
_____ TO _____ = _____ HRS
_____ TO _____ = _____ HRS
_____ TO _____ = _____ HRS
_____ TO _____ = _____ HRS

d. FIRE RESISTANCE OF EXTERIOR WALLS: (SEE TABLE 5-A)

NORTH _____

SOUTH _____
EAST _____
WEST _____
OTHER _____

e. OPENINGS IN EXTERIOR WALLS: (SEE TABLE 5-A)

NORTH _____
SOUTH _____
EAST _____
WEST _____
OTHER _____

f. MAX. ALLOWABLE FLOOR AREA (SEE TABLE 5-C):

ALLOWABLE:

IF SPRINKLERED: _____

ALLOW. AREA INCREASES _____
_____
_____
_____
_____

CALCULATED ACTUAL FLOOR AREA:

Floor Square Footage

Totals:

g. MAX. ALLOWABLE HEIGHT (SEE TABLE 5-D):

METERS (FEET): _____
STORIES: _____

Proposed Height of Building: _____

Actual No. of Stories: _____

h. COMMENTS:

_____
_____
_____
_____
_____

DESIGNER:_____

3.9.1.2 NFPA 101 "LIFE SAFETY CODE"

a. CLASSIFICATION OF OCCUPANCY:

HAZARD OF CONTENTS:
LOW _____
_____
_____

ORDINARY _____
_____
_____

HIGH _____
_____
_____

b. FIRE RESISTIVE REQUIREMENTS:

EXTERIOR WALLS: _____ HRS _____

INTERIOR WALLS: _____ HRS _____

STRUCTURAL FRAME: _____ HRS _____

VERTICAL OPENINGS: _____ HRS _____

FLOORS: _____ HRS _____

ROOFS: _____ HRS _____

EXTERIOR DOORS: _____ HRS _____

EXTERIOR WINDOWS: _____ HRS _____

BOILER ROOM ENCLOSURE _____ HRS _____

OTHER (LIST) _____ HRS _____

_____ HRS _____

_____ HRS _____

_____ HRS _____

c. MEANS OF EGRESS:

OCCUPANCY LOAD FACTOR: _____

OCCUPANCY	FACTOR	ACTUAL AREA	ACTUAL LOAD

d. NUMBER OF EXITS REQUIRED:

e. MINIMUM WIDTH OF EXITS:

CALCULATED:

ACTUAL:

f. MAXIMUM ALLOWABLE TRAVEL DISTANCE TO EXIT:

WITH SPRINKLERS:

g. EXIT DOORS:

MINIMUM WIDTH ALLOWED:
MAXIMUM LEAF WIDTH ALLOWED:
WIDTH REQUIRED FOR NO.OF OCCUPANTS:

h. EXIT CORRIDORS:

MAX. COMMON PATH OF TRAVEL:
MINIMUM ALLOWABLE WIDTH:

REQUIRED TO HAVE EXIT AT EACH END OF CORRIDOR?
_____
DEAD END CORRIDORS ALLOWED? _____
MAXIMUM LENGTH: _____
WALL FIRE RESISTANCE REQUIRED: _____
_____
_____
DOORS & FRAME FIRE RESISTANCE REQUIRED:
_____
_____

i. STAIRS:

MINIMUM WIDTH _____ FOR OCCUP. LOAD OF _____
MINIMUM WIDTH _____ FOR OCCUP. LOAD OF _____
MINIMUM WIDTH _____ FOR OCCUP. LOAD OF _____
MINIMUM WIDTH _____ FOR OCCUP. LOAD OF _____
MAX. RISER ALLOWED: _____
MINIMUM TREAD ALLOWED: _____

LANDINGS:

MIN. SIZE: _____
MAX. VERTICAL DIST. BETWEEN LANDINGS: _____
_____
_____
REQUIRED HEIGHT OF RAILINGS:
_____
_____
HANDRAILS:

REQUIRED AT EACH SIDE? _____
INTERMEDIATE RAIL REQUIRED? _____

HEIGHT ABOVE NOSING _____
INTERMEDIATE RAIL REQUIRED? _____
MAX. SPACE ALLOWED BETWEEN RAILS: _____
_____

STAIR ENCLOSURE REQUIRED?_____

STAIR TO ROOF REQUIRED?_____

STAIR TO BASEMENT REQUIRED? _____

j. HATCHWAY ACCESS TO ROOF REQUIRED? _____

k. LADDER ACCESS TO ROOF REQUIRED?

_____

l. HORIZONTAL EXIT REQUIREMENTS:
_____
_____
_____

m. PROTECTION OF OPENINGS NEAR EXTERIOR STAIR EXIT DOORS:

_____
_____

n. SMOKEPROOF ENCLOSURE REQUIRED:
_____

_____

o. RAMPS:

MAX. SLOPE TO USE AS EXIT _____
HANDRAILS REQUIRED? _____

p. COMMENTS:
_____
_____
_____
_____
_____
_____

DESIGNER: _____

FOLLOWING IS A LIST OF ADDITIONAL "NFPA" CODES THAT ARE COMMONLY USED. INDICATE WHICH OF THESE CODES ARE USED AND ADD THOSE REQUIREMENTS TO THIS ANALYSIS.

NFPA 10	FIRE EXTINGUISHERS, PORTABLE
NFPA 75	COMPUTER/DATA PROCESSING FACILITIES
NFPA 80	FIRE DOORS AND WINDOWS
NFPA 88A	PARKING STRUCTURES
NFPA 409	AIRCRAFT HANGARS
AFM 88-4	DATA PROCESSING FAC. DESIGN AND CONST.
AF ETL 89-3	FIRE PROTECTION CRITERIA FOR ELECTRONIC

Typed Name and Signature of the
Licensed Architect/Engineer of Record
Professional Seal of the Licensed Architect/Engineer of Record

3.9.2 **ATTACHMENT B**

ADA ARCHITECTURAL DESIGN CHECKLIST

Project Name:_____
Project Location:_____
Design Phase:_____

ITEM NO.		INCORP	N/A	LATER
1.	Established with the Base/owner of the facility the requirements for handicap accessibility.	____	_____	_____
2.	Received a waiver for no handicap accessibility requirements on the facility.	_____	_____	_____
3.	Facility is designed utilizing:			
	New Construction Criteria	_____	_____	_____
	Building Alteration Criteria	_____	_____	_____
	Historic Building Preservation Criteria:	_____	_____	_____
4.	Accessible Route (egress/corridors/halls/aisles).			
	- Provided minimum fire egress routes.	_____	_____	_____
	- Provided minimum site accessible routes.	_____	_____	_____
	- Provided proper clearance widths.	_____	_____	_____
	- Provided proper floor level changes.	_____	_____	_____
	- Provided proper floor materials.	_____	_____	_____
	- Provided protection from protruding objects.	_____	_____	_____
5.	Ramps:			
	- Maximum slopes less than 1:12	_____	_____	_____
	- Maximum run less than 30 feet for 1:12 slopes 40 feet for 1:16 slopes	_____	_____	_____
	- Minimum clear width exceeds 914mm.	_____	_____	_____
	- Provided proper edge protection.	_____	_____	_____
	- Provided handrails of proper configuration and diameter.	_____	_____	_____
	- Provided proper handrail extensions at top and bottom of ramp.	_____	_____	_____
	- Provided handrails at proper mounting heights.	_____	_____	_____
	- Provided proper landings.	_____	_____	_____
	- Provided proper cross slope on ramp surface.	_____	_____	_____

ITEM NO.	INCORP	N/A	LATER
6. Stairs:			
- Protected the space below stairs from access by the blind.	_____	_____	_____
- Provided handrails of proper configuration and diameter.	_____	_____	_____
- Provided proper handrail extensions at top and bottom of stairs.	_____	_____	_____
- Provided handrails at proper mounting heights.	_____	_____	_____
- Provided treads greater than 280mm in width.	_____	_____	_____
- Provided Proper nosings.	_____	_____	_____
7. Elevators:			
- Provided buttons and lanterns at the proper mounting height.	_____	_____	_____
- Provided Braille characters.	_____	_____	_____
- Provided proper door widths.	_____	_____	_____
- Provided proper clearance inside elevator car.	_____	_____	____
8. Doors And Hardware:			
- Provided proper door widths.	_____	_____	_____
- Provided proper clearance on both sides of jambs.	_____	_____	_____
- Entrance vestibules provided with adequate clearances.	_____	_____	_____
- Provided levers on locksets and exit hardware.	_____	_____	_____
- Provided closers with mechanical adjustments.	_____	_____	_____
- Provided accessible thresholds.	_____	_____	_____
- Provided protection plates on doors heavily used by wheel chair bound people.	_____	_____	_____

ITEM NO.		INCORP	N/A	LATER
9.	Toilet Facilities:			
	- Provided proper floor clearance through out the toilet rooms.	_____	_____	_____
	- Provided minimum number of required accessible fixtures.	_____	_____	_____
	- Provided accessible toilet stalls.	_____	_____	_____
	- Provided stall doors with correct direction of swing.	_____	_____	_____
	- Provided accessible water closets.	_____	_____	_____
	- Provided grab bars at accessible water closets.	_____	_____	_____
	- Provided grab bars with correct configuration and dimension.	_____	_____	_____
	- Provided accessible sinks/lavatories.	_____	_____	_____
	- Provided accessible urinals.	_____	_____	_____
	- Provided accessible water coolers and fountains.	_____	_____	_____
	- Provided accessible mirrors.	_____	_____	_____
	- Provided accessible toilet accessories at required locations.	_____	_____	_____
	- Provided all fixtures and accessories at proper mounting heights and clearances.	_____	_____	_____
	- Provided insulated or protected exposed pipes at lavatories.	_____	_____	_____
10.	Shower/Tub Facilities:			
	- Provided the minimum number of accessible showers/tubs.	_____	_____	_____
	- Provided showers/tubs with grab bars.	_____	_____	_____
	- Provided showers/tubs with seats as required.	_____	_____	_____
	- Provided controls mounted at the proper height and location.	_____	_____	_____
	- Provided proper clearances and dimensions in showers/tubs.	_____	_____	_____
	- Provided proper floor clearance through out shower/tubs rooms.	_____	_____	_____
	- Provided doors with correct direction of swing and clearance.	_____	_____	_____

ITEM NO.		INCORP	N/A	LATER	
11.	Storage:				
	- Provided accessible cabinets, shelves, closets, and drawers as required.	_____	_____	_____	
	- Provided proper clearance, mounting heights, and reach provisions.	_____	_____	_____	
12.	Telephones and Vending:				
	- Provided the minimum number of required accessible public telephones.	_____	_____	_____	
	- Provided proper floor clearance around telephone.	_____	_____	_____	
	- Phone and controls mounted at proper heights and within reach.	_____	_____	_____	
	- Provided vending machines on an accessible route.	_____	_____	_____	
	- Provided vending machines with accessible clearances and protruding object safe guards.	_____	_____	_____	
13.	Fixed Or Built-in Seating And Tables:				
	- Provided the minimum number of accommodations for accessibility in areas which required fixed furniture.	_____	_____	_____	
	- Provided proper floor clearance around furniture.	_____	_____	_____	
	- Provide proper knee space at tables.	_____	_____	_____	
	- Provided tables and counters with proper top surface heights.	_____	_____	_____	
14.	Assembly Areas:				
	- Provided the minimum number of accessible seating spaces.	_____	_____	_____	
	- Provided seating which is easily accessible to emergency egress.	_____	_____	_____	
	- Provided companion seating.	_____	_____	_____	
	- Integrated and dispersed accessible seating with the rest of the seating.	_____	_____	_____	
	- Provided accessible dressing rooms.	_____	_____	_____	
	- Provided level floor surface at accessible seat locations.	_____	_____	_____	
	- Provided clear ground or floor space at accessible seat locations	_____	_____	_____	
	- Provided access to all performing areas and associated spaces.	_____	_____	_____	

ITEM NO.		INCORP	N/A	LATER
15.	Dining Halls And Cafeterias:			
	- Provided the minimum number of accessible dining spaces.	_____	_____	_____
	- Provided accessible counters and bars.	_____	_____	_____
	- Provided accessible aisles between tables or walls.	_____	_____	_____
	- Provided clear floor space at accessible dining locations.	_____	_____	_____
	- Provided accessible food service lines meeting minimum clearances and reaches.	_____	_____	_____
	- Provided accessible tableware and condiment areas.	_____	_____	_____
	- Provided raised speaker platform with protected edges.	_____	_____	_____
16.	Medical Care Facilities:			
	- At least 10% of the general patient rooms are accessible.	_____	_____	_____
	- Provided the number of accessible patient rooms as required for specialized treatment,long term care, or alterations of existing patient rooms.	_____	_____	_____
	- Provided at least one accessible entrance with weather protecting canopy or roof overhang.	_____	_____	_____
	- Provided minimum clearances within the patient rooms and around the beds.	_____	_____	_____
	- Provided accessible patient toilet/bath rooms.	_____	_____	_____
17.	Business And Mercantile:			
	- Provided at least one accessible sales counter, services counter, teller, information window, etc.	_____	_____	_____
	- Security bollards when provided, do not prevent access or egress to people in wheel chairs.	_____	_____	_____
18.	Libraries:			
	- Provided access to all reading and stack areas, reference reference rooms, reserve areas, and special facilities or collections.	_____	_____	_____
	- Provided at least 5% or a minimum of one of each element or fixed seating, tables, or study carrels as accessible	_____	_____	_____
	- Provided at least one lane of check out areas as accessible.	_____	_____	_____
	- Provided adequate clearance and reach distances at card catalogs and magazine displays.	_____	_____	_____
	- Provide stacks with minimum clear aisle width.	_____	_____	_____

ITEM NO.		INCORP	N/A	LATER
19.	Temporary Lodging:			
	- All common and public use areas are accessible.	_____	_____	_____
	- Provided accessible units, sleeping rooms, and suites.	_____	_____	_____
	- Provided sleeping accommodations for persons with hearing impairments.	_____	_____	_____
	- Provided a dispersed class and a range of room options.	_____	_____	_____
	- Provided accessible rooms in ADAL projects.	_____	_____	_____
	- Provided an accessible route to accessible sleeping rooms.	_____	_____	_____
	- Provided accessible clearance widths within sleeping rooms and around beds.	_____	_____	_____
	- Provided accessible doors within accessible sleeping rooms.	_____	_____	_____
	- Provided accessible fixed or built-in furniture and storage units.	_____	_____	_____
	- Provided accessible controls throughout accessible units.	_____	_____	_____
	- Where provided as part of an accessible unit each of the following were provided as accessible: living area, dining area, at least one sleeping area, patio/terrace, balcony, toilet/bath, and carport/garage/parking.	_____	_____	_____
	- Where provided as apart of an accessible unit, the kitchen, kitchenettes, wet bars, or similar amenities were also provided with accessible features.	_____	_____	_____
	- Provided visual alarms, notification devices, and accessible telephones.	_____	_____	_____
	- Provided accessible doors and doorways designed to allow passage into and within all sleeping units or other covered units.	_____	_____	_____

20. Transportation Facilities:

(This section covers Air, Rail, and Bus public transportation facilities. See Section 10 of the ADA Guide for specific requirements for these facilities)

3.9.3 **ATTACHMENT C**

MECHANICAL ROOM SIZE FORM

****

NOTE: Mechanical Systems Design Documents and Guides - Mechanical Room Size Form

At the final design stage, the mechanical designer shall fill out this Mechanical Room Size Form and include it in the final design calculations.

****

The information submitted on this sheet shall be placed in a data base for future use on similar DoD, COE project. (The data base shall be used to help determine appropriate mechanical room sizes). Include this sheet in the final design calculations.

Project:

Location:

Engineer:

Gross floor area of building:

Gross square footage includes (the entire building) stairs, corridors, etc.

Floor area of mechanical room:

Percent of gross building area is the mechanical room size:

Type of facility:

Sources of energy (E, G, S):

Mechanical equipment:

List of equipment outside the mechanical room and location:

Is the mechanical room too small?

Does the User think the mech room is too small? (Y, N, Don't know)

Additional remarks:

Abbreviations:

AC - air compressor
AHU - air handling unit
B - boiler
CU - air cooled condensing unit
DF - direct fired
DX - direct expansion chilled water heat exchanger
E - electric

FC - fan coil unit
FP - fire protection
G - natural gas or propane
HX - heat exchanger
LC - liquid chiller
MUA - make up air unit
UH - unit heater
ST - domestic hot water storage tank
S - steam

-- End of Section --

SECTION 01770

CONTRACT CLOSEOUT
04/2001
AMENDMENT NO. 0001, 0002 & 0006

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

MILITARY SPECIFICATIONS (MIL)

MIL-M-9868E	Microfilming of Engineering Data, 35mm, Requirements For

TRI-SERVICE CADD/GIS TECHNOLOGY CENTER (TSC)

TSC-01	A/E/C CADD Standard Manual (Current Release as of Contract Award date)

U.S. ARMY CORPS OF ENGINEERS (COE)

COE-02	ARCHITECTURAL AND ENGINEERING INSTRUCTIONS MANUAL (SWD-AEIM), Southwestern Division (Current issue as of Contract Award date)

1.2 PAYMENT

Contract closeout activities such as, but not limited to, operation and maintenance manuals, record drawings, warranty requirements, equipment warranty identification tags, and inventories, real property maintenance records, payrolls, and shop drawing submittals, are subsidiary activities of the contract work; separate payment will not be made for any activity unless otherwise specified. Final contract payment will not be made until completion and approval of all contract closeout activities.

1.3 HVAC TESTING

The HVAC Testing that the Contractor schedules after substantial completion pursuant to paragraph entitled "Testing of Heating and Air-Conditioning Systems" of Section 01000 DESIGN AND CONSTRUCTION SCHEDULE has a value to the Government of 10 percent of the value of the equipment to be tested. The Contractor shall reserve that amount to be paid on any equipment that will require testing after substantial completion pursuant to the above referenced specification paragraph.

1.4 OPERATION AND MAINTENANCE MANUALS

The Contractor shall be responsible for the preparation, coordination, execution and submittal of all operation and maintenance manuals (O & M Manuals), including spare parts lists, special tools, inventories of equipment manuals and maintenance instructions, and shall conduct all

training for operating and service personnel. Operation and maintenance manuals shall cover all system installations provided in this contract and shall be in sufficient detail to facilitate normal maintenance and troubleshooting by persons with minimum experience with the installed equipment.

1.4.1 Submittal Requirements

All of the above listed items required in the technical specifications shall be submitted to the Contracting Officer not less than 90 days prior to the scheduled contract completion date. Fully developed and approved operation and maintenance manuals shall be provided 30 days prior to scheduling training for operating and service personnel. The Contractor shall coordinate the content of each instruction period required in the technical specifications with the Contracting Officer's Representative prior to the actual start of the training period.

1.4.1.1 Video taping of Training for Operating and Service Personnel

Each instruction or training period as discussed above, shall be video taped in VHS FORMAT by the Contractor. The taping shall include the entire session(s). The original video tape(s) shall be labeled and turned over to the Contracting Officer. The video camera and tapes utilized by the Contractor, shall be of a quality to enable clear and understandable playbacks of the recorded events.

1.4.1.2 Draft O & M Manuals

On those systems where complete and comprehensive operation and maintenance manuals cannot be fully developed until the system(s) is checked, tested, and/or balanced, and the checking, testing, and/or balancing has not been done when submittals are required, a proposed draft of those system manual(s) shall be submitted. 10 percent of the each subsequent scheduled progress payment will be retained until the complete O & M Manuals submittal package have been submitted and approved. Submit fully developed O & M Manuals of the drafts for approval after the systems have been checked, tested, and/or balanced.

1.4.1.3 Commencement of Warranty of Construction

Failure to submit all specified O & M manuals, spare parts listings, spare parts, special tools, inventories of installed property, and training video tapes in a timely manner will be considered as delaying substantial completion of the work. Commencement of warranty under the Contract Clause WARRANTY OF CONSTRUCTION will not occur until all these items are delivered and approved by the Contracting Officer, but not earlier than the date of final acceptance of the work by the Government. When the O & M Manuals with drafts are approved they will not constitute a reason for delaying the start of the warranty period.

1.4.2 Government Possession of Work

The Government may take possession of any completed or partially completed work as provided for under Contract Clause entitled "USE AND POSSESSION PRIOR TO COMPLETION." If the installed equipment and/or systems thereto, have not been accepted by the Government due to the Contractor's failure to submit the above specified items, the Contractor shall operate and maintain such plant or system at no additional cost to the Government until such time that the specified items have been received, approved and any

subsequent testing, check-out and/or training has been completed.

1.5 PREPARATION AND SUBMISSION OF OPERATION AND MAINTENANCE MANUALS

This paragraph establishes general requirements for the preparation and submission of equipment operating, maintenance, and repair manuals as called for in the various sections of the specifications. Specific instruction(s) relating to a particular system or piece of equipment shall be incorporated into the manuals in accordance with the applicable technical specification.

1.5.1 General Requirements

Furnish operations and maintenance manuals on CD-ROM disk along with a single hard copy. Documents on the CD-ROM disk shall be in portable document format (.pdf); all printed and graphic documents, drawings, and illustrations shall be legible. Hard copy requirements are specified below.

1.5.1.1 Hard Cover Binders

The manuals shall be permanently bound and have a hard cover. The following identification shall be inscribed on the cover: the words "EQUIPMENT OPERATING, MAINTENANCE, AND REPAIR MANUAL:" and the name, building number, location, and indication of utility or systems covered. Manuals shall be approximately 216 mm by 279 mm (8-1/2 by 11 inches) with large sheets folded in and capable of being easily pulled out for reference. All manuals for a single facility must be similar in appearance.

1.5.1.2 Warning Page

A warning page shall be provided to warn of potential dangers (if they exist), such as high voltage, toxic chemicals, flammable liquids, explosive materials, carcinogens, or high pressures. The warning page shall be placed inside the front cover, in front of the title page.

1.5.1.3 Title Page

The title page shall show the name of the preparing firm (designer or contractor) and the date of publication.

1.5.1.4 Table of Contents

Provide in accordance with standard commercial practice.

1.5.2 Equipment Operating, Maintenance, and Repair Manuals

1.5.2.1 General

Separate manuals shall be provided for each utility system as defined hereinafter. Manuals shall be provided in the number of copies specified in the applicable technical section. Manuals shall include, in separate sections, the following information for each item of equipment:

a. Performance sheets and graphs showing capacity data, efficiencies, electrical characteristics, pressure drops, and flow rates. Marked-up catalogs or catalog pages do not satisfy this requirement. Performance information shall be presented as concisely as possible and contain only data pertaining to equipment actually installed.

b. Catalog cuts showing application information.

c. Installation information showing minimum acceptable requirements.

d. Operation and maintenance requirements. Include adequate illustrative material to identify and locate operating controls, indicating devices and locations of areas or items requiring maintenance.

(1) Describe, in detail, starting and stopping procedures for components, adjustments required to obtain optimum equipment performance, and corrective actions for malfunctions.

(2) Maintenance instructions describing the nature and frequency of routine maintenance and procedures to be followed. Indicate any special tools, materials, and test equipment that may be required.

e. Repair information including diagrams and schematics, guidance for diagnosing problems, and detailed instructions for making repairs. Provide troubleshooting information that includes a statement of the indication or symptom of trouble and the sequential instructions necessary. Include test hookups to determine the cause, special tools and test equipment, and methods for returning the equipment to operating conditions. Information may be in chart form or in tabular format with appropriate headings.

f. Parts lists and names and addresses of closest parts supply agencies.

g. Names and addresses of local manufacturers representatives.

1.5.2.2 Facility Heating Systems

Information shall be provided on the following equipment: Boilers, water treatment, chemical feed pumps and tanks, converters, heat exchangers, pumps, unit heaters, fin-tube radiation, air handling units (both heating only and heating and cooling), and valves (associated with heating systems).

1.5.2.3 Air-Conditioning Systems

Provide information on chillers, packaged air-conditioning equipment, towers, water treatment, chemical feed pumps and tanks, air-cooled condensers, pumps, compressors, air handling units, and valves (associated with air-conditioning systems).

1.5.2.4 Temperature Control and HVAC Distribution Systems

a. Provide the information described for the following equipment:

Valves, fans, air handling units, pumps, boilers, converters, and heat exchangers, chillers, water cooled condensers, cooling towers, and fin-tube radiation.

b. Provide all information described for the following equipment:

Control air compressors, control components (sensors, controllers, adapters, and actuators), and flow measuring equipment.

1.5.2.5 Central Heating Plants

Provide the information described for the following equipment: Boilers,

converters, heat exchangers, pumps, fans, steam traps, pollution control equipment, chemical feed equipment, control systems, fuel handling equipment, de-aerators, tanks (flash, expansion, return water, etc.), water softeners, and valves.

1.5.2.6 District Heating Distribution Systems

Provide the information described for the following equipment: Valves, fans, pumps, converters and heat exchangers, steam traps, tanks (expansion, flash, etc.) and piping systems.

1.5.2.7 Exterior Electrical Systems

Information shall be provided on the following equipment: Power transformers, relays, reclosers, breakers, and capacitor bank controls.

1.5.2.8 Interior Electrical Systems

Information shall be provided on the following equipment: Relays, motor control centers, switchgear, solid state circuit breakers, motor controller, and EPS lighting systems, control systems (wire diagrams and troubleshooting flow chart), and special grounding systems.

1.5.2.9 Energy Management and Control System

The maintenance manual shall include descriptions of maintenance for all equipment, including inspection, periodic preventative maintenance, fault diagnosis, and repair or replacement of defective components.

1.5.2.10 Domestic Water Systems

The identified information shall be provided on the following equipment: Tanks, unit process equipment, pumps, motors, control and monitoring instrumentation, laboratory test equipment, chemical feeders, valves, switching gear, and automatic controls.

1.5.2.11 Wastewater Treatment Systems

The identified information shall be provided on the following equipment: Tanks, unit process equipment, pumps, motors, control and monitoring instrumentation, laboratory test equipment, chemical feeders, valves, scrapers, skimmers, comminutors, blowers, switching gear, and automatic controls.

1.5.2.12 Fire Protection Systems

Information shall be provided on the following equipment: Alarm valves, manual valves, regulators, foam and gas storage tanks, piping materials, sprinkler heads, nozzles, pumps, and pump drivers.

1.5.2.13 Fire Detection Systems

The maintenance manual shall include description of maintenance for all equipment, including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

1.5.2.14 Plumbing Systems

Information shall be provided on the following equipment: Water heaters,

valves, pressure regulators, backflow preventors, piping materials, and plumbing fixtures.

1.5.2.15 Cathodic Protection Systems

Information shall be provided on the following material and equipment: Rectifiers, meters, anodes, anode backfill, anode lead wire, insulation material and wire size, automatic controls (if any), rheostats, switches, fuses and circuit breakers, type and size of rectifying elements, type of oil in oil-immersed rectifiers, and rating of shunts.

1.5.2.16 Generator Installations

Information shall be provided on the following equipment: Generator sets, automatic transfer panels, governors, exciters, regulators, starting systems, switchgear, and protective devices.

1.5.2.17 Miscellaneous Systems

Information shall be provided on the following: Communication and ADP systems, security and intrusion alarm, elevators, material handling, active solar, photovoltaic, and other similar type special systems not otherwise specified.

1.6 RECORD DRAWINGS

Record drawings shall be a record of the construction as installed and completed by the Contractor. They are a record of all deviations, modifications, or changes from (the accepted 100% construction drawings), however minor, which were incorporated in the work. They include all the information shown on the contract set of drawings, any Contractor-original drawings, all additional work not appearing on the contract drawings, and all changes which are made after final inspection of the contract work.

1.6.1 Contractor-Original Record Drawings

Contractor-original record drawings are those drawings drawn by the Contractor, after acceptance of the 100% design documents and the start of construction, to further explain the Contract documents such as subcontractor submittals for fire protection/detection, communication, and other systems, and accepted Contractor's solutions to problems. Submit these drawings as full-size reproducible sheets and CADD files. CADD files shall conform to the Working CADD file requirements specified in paragraph "Final Record Drawings."

1.6.2 Preliminary Record Drawings

The Contractor shall mark up both a reproducible set and a set of prints to show as-built conditions. These two sets, hereafter called preliminary record drawings, or singly, reproducibles or prints, shall be kept current and available on the jobsite at all times, except as noted below. A member of the Contractor's Quality Control Organization shall be assigned responsibility for the maintenance and currency of the preliminary record drawings. This assignment and any reassignment of duties concerning the maintenance of the record drawings shall be promptly reported to the Contracting Officer's representative for approval. All changes from the contract drawings which are made in the work or additional information which might be uncovered in the course of construction, including uncharted utilities, shall be accurately and neatly recorded as they occur by means

of details and notes. All changes and/or required additions to the preliminary record drawings shall be clearly identified in a contrasting color and which is compatible with reproduction of the preliminary record drawings. Preliminary record drawings shall be updated by Friday of each week. During periods when the reproducibles are being copied and are therefore not available at the jobsite, the Contractor shall continue posting all required data to the prints. The Contractor shall minimize the time that the reproducibles are away from the jobsite and shall update them with all as-built data immediately upon their return. The preliminary record drawings will be jointly inspected for accuracy and completeness by the Contracting Officer's representative and the assigned representative of the Contractor's Quality Control Organization prior to submission of each monthly pay estimate. See paragraph, "Withholding for Preliminary Record Drawings." The record drawings shall show the following information, but not be limited thereto:

a. The location and description of utility lines or other installation of any kind or description known to or found to exist within the construction area. The location of exterior utilities includes actual measured horizontal distances from utilities to permanent facilities/ features. These measurements shall be within an accuracy range of 150 mm and shall be shown at sufficient points to permit easy location of utilities for future maintenance purposes. Measurements shall be shown for all change of direction points and all surface or underground components such as valves, manholes, drop inlets, cleanouts, meter, etc. The general depth range of each underground utility line shall be shown (i.e., 900 mm to 1200 mm in depth). The description of exterior utilities includes the actual quantity, size, and material of utility lines.

b. The location and size of all uncharted existing utilities encountered.

c. The location and dimensions of any changes within the building or structure.

d. Correct grade or alinement of roads, structures or utilities if any changes were made from contract drawings.

e. Correct elevations if changes were made in site grading.

f. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

g. The topography and grades of all drainage installed or affected as a part of the project construction.

h. Options

Where contract drawings or specifications allow options, only the option selected for construction shall be shown on the record drawings.

1.6.2.1 Blue Line or Black Line Prints

Blue line or black line prints shall be full size. All blue or black line prints shall exhibit good readable print with clear, sharp, dark lines, and shall not be smeared, faded, double imaged, or have torn or ragged edges.

1.6.2.2 Prefinal Inspection For Each Item of Work

As part of the prefinal inspection for each item of work, the preliminary record drawings will be reviewed. They shall comply with this specification prior to scheduling the final inspection, and/or prior to substantial completion of the item of work.

1.6.2.3 Preliminary Record Drawing Final Submittal

Prior to scheduling the final acceptance inspection of the last or only bid schedule item of work, the preliminary record drawings shall be completed and delivered to the Contracting Officer's Representative for review and acceptance. If upon review, the drawings are found to contain errors and/or omissions, they will be returned to the Contractor for corrections. Failure of the Contractor to make timely delivery of the preliminary record drawings on any or all items of work will be cause for the Government to delay substantial completion and to assess liquidated damages in accordance with the terms and conditions of the contract.

1.6.2.4 Withholding for Preliminary Record Drawings

Failure by the Contractor to maintain current and satisfactory preliminary record drawings in accordance with these requirements will result in withholding from progress payments 10 percent of the progress payment amount until such time as the record drawings are brought into compliance. This withheld amount will be indicated on monthly payment estimates until the Contractor has fulfilled these contract requirements.

1.6.2.5 Final Inspection

For each interim item of work, furnish a copy of the preliminary record drawings for that item, which the Contractor has reproduced from the approved preliminary record drawing reproducibles, to the Contracting Officer's representative at the time of final inspection for that item. At the time of final inspection on the last or only item of work, the Contractor shall deliver a copy of the complete set of the approved preliminary record drawings to the Contracting Officer's Representative.

1.6.3 Final Record Drawings (CADD Record Drawings)

Upon approval of the preliminary record drawings, the Contracting Officer will return the approved preliminary record drawing prints back to the Contractor. The Contractor will then modify the CADD files as may be necessary to correctly show all the features of the project as it was constructed by bringing the contract set into agreement with the preliminary record drawings, including adding additional drawings and CADD files as may be necessary. The Contractor shall furnish the as-built drawings in the same file format as the Working CADD files. The Working CADD files will be furnished to the Contractor. The CADD files are located on the Contract CD-ROM disk in Bentley Systems MicroStation, . The Working CADD files are in Bentley Systems MicroStation format.] These CADD files are part of the permanent records of this project and the Contractor shall be responsible for the protection and safety thereof until final submittal to the Contracting Officer. Drawings, tracings, or CADD files damaged or lost by the Contractor shall be satisfactorily replaced by the Contractor at the Contractor's expense. CADD files will be audited by the Contracting Officer and for accuracy and conformance to the above specified drafting and CADD standards.

1.6.3.1 Drafting

Only personnel proficient in the preparation of engineering drawings and CADD shall be employed to modify the original contract drawings, prepare additional new drawings, and modify the CADD files. All modifications and new drawings shall conform to applicable requirements specified in the paragraph "CADD Standards." The Contractor shall ensure that all delivered CADD digital files and data (e.g., sheet files, model files, cell/block libraries) are compatible with the Government's target CADD system and operating system, and adhere to the standards and requirements specified. The term "compatible" means that data is in native digital format i.e., .dgn (MicroStation) or .dwg (AutoCAD). It is the responsibility of the Contractor to ensure this level of compatibility.

1.6.3.2 CADD Standards

CADD Standards are specified in Section 01016 DESIGN DOCUMENT REQUIREMENTS. CADD drawings shall be prepared in accordance with the applicable general and discipline-specific provisions for drawing formats, level/layer assignments, line colors, line weights, and line types of the TSC-01 (Tri-Service A/E/C Standards).

CADD standards are located at the following Web sites:

http://tsc.wes.army.mil/products/standards/aec/aecstdweb.asp

Seed/prototype files, containing the Government's preset standard metric/English settings can be downloaded from the Internet at the following address:

http://tsc.wes.army.mil/products/standards/aec/aecstdweb.asp

Electronic reference files containing the Government's standard border/title block sheets can be downloaded from the Internet at the following address:

http://tsc.wes.army.mil/products/standards/aec/aecstdweb.asp

The Contractor shall submit a written request for approval of any deviations from the Government's established CADD standards. Deviations will not be permitted unless prior written approval of such deviations has been received from the Government.

1.6.3.3 Final Revisions

When final revisions have been completed, place the words "REVISED RECORD DRAWING," in letters at least 5 mm high, and the date of completion in the revision block above the latest existing revision notation on each drawing CADD file.

1.6.3.4 Border Sheets

The border sheet to be used for any new record drawings shall be the same as used on the original drawings.

1.6.3.5 Copies of the Final Record Drawings

Blue line or black line prints shall be full size. All blue or black line

prints shall exhibit good readable print with clear, sharp, dark lines, and shall not be smeared, faded, double imaged, or have torn or ragged edges.

1.6.3.6 Submittal Requirements

The Contractor shall submit to the Contracting Officer the final record drawings, consisting of one set of full size blue line or black line prints, one full size vellum reproducible set, and two sets of corrected CADD files on CD-ROM disks; verification that the CADD files have been loaded and work on the designated computer systems and are error- and virus-free; the approved preliminary blue lines; and all required reproduced items. All paper prints, reproducible drawings, and CADD files will become the property of the Government.

a. Sustainable Design (AM#2) (AM#6)

Submit a final update the Contractor's Sustainable Project Rating Tool (SPiRiT) sheets indicating the status of design related to the listed elements and the achievement of the specified rating. Provide letter certifying the achievement of the specified rating. (AM#6)

1.6.4 Post-Record Drawing Work

In event the Contractor accomplishes additional work which changes the as-built conditions of the facility after submission of the record drawings, the Contractor shall furnish revised and/or additional drawings (hard copy and CADD files), as required to depict as-built conditions. The requirements for these additional drawings, including CADD files, will be the same as for the record drawings included in the original submission.

1.6.5 Payment for Final Record Drawings

The amount listed for Final Record Drawings in the Bidding Schedule will be paid to the Contractor upon the Contracting Officer's acceptance of the completed record drawings.

1.7 ADDITIONAL WARRANTY REQUIREMENTS

The warranty requirements specified in this paragraph are in addition to those specified in the Contract Clause WARRANTY OF CONSTRUCTION in Section 00700 CONTRACT CLAUSES.

1.7.1 Performance Bond

It is understood that the Contractor's Performance Bond will remain effective throughout the life of all warranties and warranty extensions. This paragraph is applicable to the Contractor's Warranty of Construction only and does not apply to manufacturers' warranties on equipment, roofing, and other products.

(a) In the event the Contractor or the Contractor's designated representative fails to commence and diligently pursue any work required under the Warranty of Construction Paragraph within a reasonable time after receipt of written notification pursuant to the requirements thereof, the Contracting Officer shall have a right to demand that said work be performed under the Performance Bond by making written notice on the surety. If the surety fails or refuses to perform the obligation it assumed under the Performance Bond, the Contracting Officer shall have the work performed by others, and after completion of the work, shall make

demand for reimbursement of any or all expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

(b) Warranty repair work which arises to threaten the health or safety of personnel, the physical safety of property or equipment, or which impairs operations, habitability of living spaces, etc., will be handled by the Contractor on an immediate basis as directed verbally by the Contracting Officer or the Contracting Officer's authorized representative. Written verification will follow verbal instructions. Failure of the Contractor to respond as verbally directed will be cause for the Contracting Officer or the Contracting Officer's authorized representative to have the warranty repair work performed by others and to proceed against the Contractor as outlined in the paragraph (a) above.

1.7.2 Pre-Warranty Conference

Prior to contract completion and at a time designated by the Contracting Officer or Contracting Officer's authorized representative, the Contractor shall meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of Contract Clause WARRANTY OF CONSTRUCTION. Communication procedures for Contractor notification of warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer or Contracting Officer's authorized representative for the execution of the construction warranty shall be established/reviewed at this meeting.

In connection with these requirements and at the time of the Contractor's quality control completion inspection, the Contractor will furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue warranty work action on behalf of the Contractor. This single point of contact will be located within the local service area of the warrantied construction, will be continuously available, and will be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of Contractor's responsibilities in connection with Contract Clause WARRANTY OF CONSTRUCTION.

1.7.3 Equipment Warranty Identification Tags

The Contractor shall provide warranty identification tags on all equipment installed under this contract. Tags and installation shall be in accordance with the requirements of Paragraph: EQUIPMENT WARRANTY IDENTIFICATION TAGS.

1.7.4 Contractor's Response to Construction Warranty Service Requirements

Following oral or written notification by the Contracting Officer, the Contractor shall respond to construction warranty service requirements in accordance with the "Construction Warranty Service Priority List" and the three categories of priorities listed below. The Contractor shall submit a report on any warranty item that has been repaired during the warranty period. The report shall include the cause of the problem, date reported, corrective action taken, and when the repair was completed. **If the Contractor does not perform the construction warranty within the timeframes specified, the Government will perform the work and backcharge the construction warranty payment item established. (AM#1)**

a. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.

b. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.

c. Third Priority Code 3. All other work to be initiated within 3 work days and work continuously to completion or relief.

d. The "Construction Warranty Service Priority List" is as follows:

Code 1-Air Conditioning Systems
(1) Recreational support.
(2) Air conditioning leak in part of building, if causing damage.
(3) Air conditioning system not cooling properly.

Code 1-Doors
(1) Overhead doors not operational, causing a security, fire, or safety problem.
(2) Interior, exterior personnel doors or hardware, not functioning properly, causing a security, fire, or safety problem.

Code 3-Doors
(1) Overhead doors not operational.
(2) Interior/exterior personnel doors or hardware not functioning properly.

Code 1-Electrical
(1) Power failure (entire area or any building operational after 1600 hours).
(2) Security lights
(3) Smoke detectors

Code 2-Electrical
(1) Power failure (no power to a room or part of building).
(2) Receptacle and lights (in a room or part of building).

Code 3-Electrical
Street lights.

Code 1-Gas
(1) Leaks and breaks.
(2) No gas to family housing unit or cantonment area.

Code 1-Heat
(1). Area power failure affecting heat.
(2). Heater in unit not working.

Code 2-Kitchen Equipment
(1) Dishwasher not operating properly.
(2) All other equipment hampering preparation of a meal.

Code 1-Plumbing
(1) Hot water heater failure.
(2) Leaking water supply pipes.

Code 2-Plumbing

(1) Flush valves not operating properly.
(2) Fixture drain, supply line to commode, or any water pipe leaking.
(3) Commode leaking at base.

Code 3 -Plumbing
Leaky faucets.

Code 3-Interior
(1) Floors damaged.
(2) Paint chipping or peeling.
(3) Casework.

Code 1-Roof Leaks
Temporary repairs will be made where major damage to property is occurring.

Code 2-Roof Leaks
Where major damage to property is not occurring, check for location of leak during rain and complete repairs on a Code 2 basis.

Code 2-Water (Exterior)
No water to facility.

Code 2-Water (Hot)
No hot water in portion of building listed.

Code 3-All other work not listed above.

1.8 EQUIPMENT WARRANTY IDENTIFICATION TAGS

1.8.1 General Requirements

The Contractor shall provide warranty identification tags on all Contractor and Government furnished equipment which he has installed.

1.8.1.1 Tag Description and Installation

The tags shall be similar in format and size to the exhibits provided by this specification, they shall be suitable for interior and exterior locations, resistant to solvents, abrasion, and to fading caused by sunlight, precipitation, etc. These tags shall have a permanent pressure-sensitive adhesive back, and they shall be installed in a position that is easily (or most easily) noticeable. Contractor furnished equipment that has differing warranties on its components will have each component tagged.

1.8.1.2 Sample Tags

Sample tags shall be submitted to the Contracting Officer's Authorized Representative for review and approval. These tags shall be filled out representative of how the Contractor will complete all other tags.

1.8.1.3 Tags for Warranted Equipment

The tag for this equipment shall be similar to the following. Exact format and size will be as approved by the Contracting Officer's Authorized Representative. The Contractor warranty expires (warranty expiration date) and the final manufacturer's warranty expiration dates will be determined

as specified by the Paragraph "WARRANTY OF CONSTRUCTION."

EQUIPMENT WARRANTY CONTRACTOR FURNISHED EQUIPMENT
MFG_____ MODEL NO._____
SERIAL NO._____
CONTRACT NO._____
CONTRACTOR NAME_____
CONTRACTOR WARRANTY EXPIRES_____
MFG WARRANTY(IES) EXPIRE_____

EQUIPMENT WARRANTY GOVERNMENT FURNISHED EQUIPMENT
MFG_____ MODEL NO._____
SERIAL NO._____
CONTRACT NO._____
DATE EQUIP PLACED IN SERVICE_____
MFG WARRANTY(IES) EXPIRE_____

1.8.1.4 Duplicate Information

If the manufacturer's name (MFG), model number and serial number are on the manufacturer's equipment data plate and this data plate is easily found and fully legible, this information need not be duplicated on the equipment warranty tag.

1.8.2 Execution

The Contractor will complete the required information on each tag and install these tags on the equipment by the time of and as a condition of final acceptance of the equipment. The Contractor will schedule this activity in the Contractor progress reporting system. The final acceptance inspection is scheduled based upon notice from the Contractor, thus if the Contractor is at fault in this inspection being delayed, the Contractor will, at the Contractor's own expense, update the in-service and warranty expiration dates on these tags.

1.8.3 Payment

The work outlined above is a subsidiary portion of the contract work, and has a value to the Government approximating 5% of the value of the Contractor furnished equipment. The Contractor will assign up to that amount, as approved by the Contracting Officer's Authorized Representative.

1.8.4 Equipment Warranty Tag Replacement

Under the terms of this contract, the Contractor's warranty with respect to work repaired or replaced shall run for one year from the date of repair or replacement. Such activity shall include an updated warranty identification tag on the repaired or replaced equipment. The tag shall be furnished and installed by the Contractor, and shall be identical to the original tag, except that the Contractor's warranty expiration date will be one year from the date of acceptance of the repair or replacement.

1.9 INVENTORY OF CONTRACTOR FURNISHED AND INSTALLED EQUIPMENT

The Contractor shall develop and maintain an up-to-date list of all equipment installed under this contract. The list shall include but not be limited to equipment that require electrical power or fuel, or may require removal or replacement such as AHUs, fans, air conditioners, compressors, condensers, boiler, thermal exchangers, pumps, cooling towers, tanks, fire hydrants, sinks, water closets, lavatories, urinals, shower stalls, and any other large plumbing fixtures, light fixtures, etc. The list shall be reviewed periodically by the Government to insure completeness and accuracy. Partial payment will be withheld for equipment not incorporated in the list. Final list shall be turned over to the Authorized Representative of the Contracting Officer at the time of contractor's quality control completion inspection.

1.9.1 Equipment Identification Number

There are two separate Equipment ID numbering systems. One is for Real Property installed equipment. The other is for Equipment in Place. Only spaces filled with significant digits will be used. Do not add zeros or blanks to fill extra spaces.

a. Real Property Installed Equipment (RFIE)

The equipment ID Number, for use with RPIE, is made of 4 parts. These parts represent the building number, the equipment type suffix, the floor the equipment is located on, and the sequence number of that type of equipment on that floor in the building.

(1) The first part is the building number.

(2) The second part, the equipment type suffix, is a 1 digit alpha-character based on IFS-M. Acceptable codes are:

(a) A - Air Conditioning Plant: Includes chillers, condensing units, etc., excludes air conditioning plants that directly support user end item equipment, such as a separate package unit to chill a computer room equipment space. Excludes window air conditioning units.

(b) B - Compressed Air/Vacuum: Note, only those that are part of the building systems such as pneumatic controls for Energy Management and Control Systems (EMCS). Does not include compressed air and vacuum systems that directly support user end items.

(c) C - Evaporative cooling and mechanical equipment.

(d) D - Dehumidification Equipment: Applies to equipment whose sole purpose is dehumidification of facilities. Excludes dehumidification that directly support user and item equipment.

(e) E - Electrical Generating Plants: Includes permanently installed generators and switch gear associated with prime power and emergency generator plants. Excludes uninterruptable power systems (UPS) equipment.

(f) F - Transformers: Does not include transformers that directly support user end items or equipment.

(g) G - Other Heating Support: Includes air handlers, circulating pumps, etc., associated with heating systems. Also includes dual (heating/cooling) air handlers, etc. Includes specialized central energy management systems EMCS, exclusive of CPU's and peripherals.

(h) H - Heating Plants: Limited to direct fired, fuel burning heating plants. Does not apply to electrical fired heaters, heat pumps, or associated equipment. See Suffixes A, G, or M.

(i) I - Substation and Switching Station: Associates with stepdown from incoming primary voltage to secondary voltage or lower voltage primary voltage.

(j) J - Sewage Pumping Plants: Includes grinder pump type sewage lift systems as well as conventional sewage lift stations, associated controls and equipment.

(k) M - Miscellaneous Utilities: Includes gas generators, cooling towers and other facility systems not otherwise identified. Excludes systems associates with and in support of user end items.

(l) N - Liquid Fuel Dispensing: Includes pumps, controls.

(m) P - Cold Storage and Refrigeration Plants: Excludes portable and prefabricated refrigeration systems which can be removed from the facility.

(n) R - Fire Extinguishing Systems: Includes standpipe and sprinkler systems, as well as fixed gas and/or chemical extinguishing systems intended for protection of the facility. Excludes portable extinguishing systems and fixed gas and/or chemical extinguishing systems intended for protection of user and item equipment. Includes specialized systems such as Engineer Smoke Control systems (ESCS) other than CPU's and associated peripherals of such systems.

(o) S - Water Pumping Plants: Applies to potable and nonpotable water pumping systems only. Excludes storm waste pumping systems which should be includes under Equipment Suffix M.

(p) T - Fire and other Alarm Systems: Excludes security alarm systems and alarm systems associated with user and item equipment such as medical refrigerators and commissary display cases. Does not include 'pumpout' and 'overflow' alarms associates with water and sewage lift stations and other similar facilities.

(q) W - Water Sources: Includes potable and non-potable well equipment and storage tanks.

(r) X - Water Treatment and Filtration Plants: Includes water softeners and deionization equipment in support of facility systems, as well as systems for processing raw water to potability standards. Excludes

systems that directly support user and item equipment.

(s) Y - Industrial Waste and Sewage Treatment Plants: Includes grease, oil, and other waste separators.

(t) Z - Special Purpose: Assigned by installation a case by case basis.

(3) The third part, the floor, is a 1 to 2 alphanumeric character. The system for defining floor number is:

(a) Floors, above and including the ground floor, are numbered in ascending order with the ground floor being equal to 1.

(b) Interstitial floors and spaces are identified by the letter 'I' and the number of the occupied floor below the interstitial space. For example, the interstitial space above the third floor of a building would be identified as: I3. Attic spaces are numbered as interstitial space.

(c) Crawl space, below the first floor, is identified as: CS.

(d) Basements and lower level floors are numbered, in descending order, with a 2 character identified. The first character is the letter 'L' and the second character is the number of the floor with the floor immediately under the ground floor being: L1.

(e) Where equipment, associates with a facility is mounted on the ground outside the physical perimeter of the facility, such as a condensing unit, the floor is identified a: G.

(4) The fourth part, the sequence number, is a 2 to 4 digit character. The first digit shall always be a slash (/). The second through fourth character is the sequential numbering (1 thru 999) of items of equipment with identical first 3 parts of the equipment ID number. For existing facilities, this will normally be given to the activity installing the equipment by the O&M Division. For new facilities, this is assigned by the activity installing the equipment.

b. For "Equipment In Place" Equipment

The equipment ID number, for use with equipment in place (i.e., end item equipment which is not an integral part of the building but which is installed in the building under this contract,) is made of 2 parts. These parts represent the Department of Defense Activity Code (DODAC) of the unit or equipment in the activity.

(1) The first part, the DODAC, is a 6 digit alpha-numeric character representing the primary user or responsible organization. It will be provided to the contractor upon request from the Contracting Officer.

(2) The second part, the sequence number, is a 1 to 4 digit character. It is the sequential numbering (1 thru 9999), of equipment in that building, belonging to the DODAC. Questions, with respect to sequence numbers, should be addressed to the O&M Division.

1.9.2 Equipment Data

List shall include on each item as applicable: Description, Manufacturer, Model or Catalog No., Serial No., Input (power voltage, BTU, etc.), Output (power, voltage, BTU, tons, etc.). Size or Capacity (tanks), and net inventory costs; any other data necessary to describe item and shall list all warrantors and warranty periods for each item of equipment.

1.10 REAL PROPERTY MAINTENANCE RECORDS

Prepare DD Form 1354, TRANSFER AND ACCEPTANCE OF MILITARY REAL PROPERTY, so that the bases can update their real property maintenance records, in accordance with the applicable bases' DPW or Base Civil Engineers' (BCE) office. This form shall contain as many of the resource code items with cost and quantity data as can be developed from the task order final documents. Obtain a general list of resource codes with cost and quantity data from the applicable bases' DPW or BCE office. This form and a sample of a completed form are attached to the end of this Section. An electronic file of the form, DD1354.frl, for use with Delrina Perform Pro Form Filler, version 16 Jul 1992, and a copy of a completed DD Form 1354 are located on the Solicitation and Contract CD-ROM disks. Contractor shall prepare the DD1354 using Delrina Perform Pro Form Filler. Contractor shall obtain DPW or BCE approval of a Draft DD1354 not less than 30 days prior to anticipated Task Order completion date. The Final DD 1354 shall be provided at the Final Inspection for Corps of Engineers and DPW or BCE signature.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section --

Sustainable Project Rating Tool (SPiRiT)

Version 1.4.1

U. S. Army Corps of Engineers
U. S. Army Assistant Chief of Staff for Installation Management

June 2002

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Content

NOTES

1) This Sustainable Project Rating Tool (SPiRiT) is derived from The U. S. Green Building Council LEED 2.0 (Leadership in Energy and Environmental Design) Green Building Rating System™.

2) The SPiRiT numbering scheme parallels, but does not match LEED 2.0. LEED does not number major sections, which it calls 'Credit Categories,' ex. 'Sustainable Sites,' rather it numbers criteria or 'credits' within each major section. SPiRiT credit numbers match those of LEED where there is a 1:1 comparison. Where additional credits have been added they fall at the end of major sections.

3) The SPiRiT Credits all follow the format: Intent, Requirement and Technologies/Strategies.

Intent: A statement of the primary goal for the credit;
Requirement: Quantifiable conditions necessary to achieve stated intent;
Technologies/Strategies: Suggested technologies, strategies and referenced guidance on the means to achieve identified requirements.

4) Projects are evaluated for each SPiRiT credit which are either 'Prerequisites' or result in a point score:

Prerequisites: These credits are a statement of minimum requirements and must be met. No further points will be awarded unless the minimum is achieved. These credits are recognizable by an 'R' in the number scheme, ex. 1.R1, and a 'Reqd.' in the score column.
Point Score: These credits are evaluated and result in a point score. Where the potential score is greater than 1, no partial points are granted.

5) SPiRiT Sustainable Project Certification Levels:

SPiRiT Bronze	25 to 34 Points
SPiRiT Silver	35 to 49 Points
SPiRiT Gold	50 to 74 Points
SPiRiT Platinum	75 to 100 Points

6) SPiRiT credits have been developed to address facility life cycle phases including programming, design, construction, and commissioning. Additional rating tools will be developed to address installation/base master planning and facilities operations and maintenance, rehabilitation, recycling, and disposal.

7) POC for U. S. Army Corps of Engineers:

Mr. Harry Goradia
U. S. Army Corps of Engineers
ATTN: CEMP-ET
441 G Street NW
Washington, DC 20314
Phone (202) 761-7170, FAX (202) 761-0633
Email harry.goradia@hq02.usace.army.mil

POC for U. S. Army Installations:

Mr. John Scharl
U. S. Army Assistant Chief of Staff for Installation Management, Directorate of Facilities & Housing
ATTN: DAIM-FDF
7701 Telegraph Road, Bldg #2594 (Room 146B),
Alexandria, VA 22315-3800
Phone (703) 428-7614, FAX (703) 428-0197
Email scharja@hqda.army.mil

8) Sustainable Project Rating Tool (SPiRiT) Authors are:
Stephen N. Flanders (Lead), U. S. Army Engineering Research & Development Center (ERDC-CRREL)
Richard L. Schneider, U. S. Army Engineering Research & Development Center (ERDC-CERL)
Donald Fournier, U. S. Army Engineering Research & Development Center (ERDC-CERL)
Annette Stumpf, U. S. Army Engineering Research & Development Center (ERDC-CERL)

9) Army/USACE employees are members of the USGBC with membership privileges accessible via the USGBC web site, http://www.usgbc.org. For information on membership and access to available LEED resources to support use of SPiRiT and sustainable design in your projects, contact Richard Schneider at (217) 373-6752 or richard.l.schneider@erdc.usace.army.mil (Annette Stumpf at (217) 352-6511 ext. 7542 or annette.l.stumpf@erdc.usace.army.mil alternate).

10) For the latest information on SPiRiT and for access to guidance, tools and resources supporting sustainable design initiatives, visit the CERL 'Sustainable Design and Development Resource' website, http://www.cecer.army.mil/SustDesign. There you may also join the CERL Sustainable Design ListServ to be directly notified of information pertinent to sustainable design.

1.0 Sustainable Sites — Score 20

1.R1 Erosion, Sedimentation, and Water Quality Control [1] — Reqd.

Intent: Control erosion and pollutants to reduce negative impacts on water and air quality.

Requirement:

- Design a site sediment and erosion control plan and a pollution prevention plan that conforms to best management practices in the EPA's Storm Water Management for Construction Activities, EPA Document No. EPA-833-R-92-001, Chapter 3, OR local Erosion and Sedimentation Control standards and codes, whichever is more stringent. The plan shall meet the following objectives:
  - Prevent loss of soil during construction by storm water runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.
  - Prevent sedimentation of storm sewer or receiving streams and/or air pollution with dust and particulate matter.
  - Prevent hazardous material discharge into storm water systems.
  - Prevent petroleum oils and lubricants (POL) discharge into storm water systems.

Technologies /Strategies: The EPA standard lists numerous measures such as silt fencing, sediment traps, oil grit separators, construction phasing, stabilization of steep slopes, maintaining vegetated ground cover and providing ground cover that will meet this prerequisite.

1.C1 Site Selection [1]

Intent: Avoid development of inappropriate sites and reduce the environmental impact from the location of a building on a site. Select site based on functional adjacencies/relationships and land use compatibility.

Requirement:

- Do not develop buildings on portions of sites that meet any one of the following criteria: **1**
  - Prime training or maneuver land.
  - Land whose elevation is lower than 5 ft. above the 100-year flood elevation as defined by FEMA.
  - Land that provides habitat for any species on the Federal or State threatened or endangered list.
  - Within 100 feet of any wetland as defined by 40 CFR, Parts 230-233 and Part 22, OR as defined by local or state rule or law, whichever is more stringent.
- Select site based on functional adjacencies/relationships and land use compatibility. **1**
  - Select sites close to existing roads and utilities or use an existing structure to minimize the need for new infrastructure.
  - Select site in area of high density.
  - Site facilities based on the strength of their relationships to other facilities/land-uses to limit travel distances. The stronger the relationship/functional interaction, the closer the distance between two facilities.
  - Select for distance to installation/base transit systems and access to pedestrian ways and bike paths.
  - Select for development previously used or developed suitable and available sites.

Technologies /Strategies: Screen potential building sites for these criteria and/or ensure that these criteria are addressed by the designer during the conceptual design phase. Utilize landscape architects, ecologists, environmental engineers, civil engineers, and similar professionals for the screening process. New wetlands constructed as part of stormwater mitigation or other site restoration efforts are not affected by the restrictions of this prerequisite.

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

1.0 Sustainable Sites (Continued)

1.C2 Installation/Base Redevelopment [1]

Intent: Channel development to installation/base cantonment areas with existing infrastructure, protecting greenfields and preserving habitat and natural resources.

Requirement:

- ✍✍ Increase localized density to conform to existing or desired density goals by utilizing sites that are located within existing cantonment areas of high development density. **1**
- ✍✍ Select sites close to existing roads and utilities or use an existing structure to minimize the need for new infrastructure. **1**

Technologies /Strategies: During the site selection process give preference to previously developed sites with installation/base cantonment redevelopment potential such as facility reduction program cleared sites.

1.C3 Brownfield Redevelopment [1]

Intent: Rehabilitate damaged sites where development is complicated by real or perceived environmental contamination, reducing pressure on undeveloped land.

Requirement:

- ✍✍ Develop on a site classified as a brownfield and provide remediation as required by EPA's Brownfield Redevelopment program requirements OR Develop a brownfield site (a site that has been contaminated by previous uses). **1**

Technologies /Strategies: Screen potential damaged sites for these criteria prior to selection for rehabilitation.

Utilize EPA OSWER Directive 9610.17 and ASTM Standard Practice E1739 for site remediation where required.

1.C4 Alternative Transportation [1]

Intent: Reduce pollution and land development impacts from automobile use.

Requirement:

- ✍✍ Locate building within ½ mile of installation/base transit systems. **1**
- ✍✍ Provide suitable means for securing bicycles, with convenient changing/shower facilities for use by cyclists, for 5% or more of building occupants. **1**
- ✍✍ Locate building within 2 miles of alternative-fuel refueling station(s). **1**
- ✍✍ Size parking capacity not to exceed minimum installation/base cantonment requirements AND provide preferred parking for carpools or van pools capable of serving 5% of the building occupants, OR, add no new parking for rehabilitation projects AND provide preferred parking for carpools or van pools capable of serving 5% of the building occupants. **1**

Technologies /Strategies: Select sites near public installation/base transit served by safe, convenient pedestrian pathways.

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

1.0 Sustainable Sites (Continued)

1.C5 Reduced Site Disturbance [1]

Intent: Conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity.

Requirement:

✍✍ On greenfield sites, limit site disturbance including earthwork and clearing of vegetation to 40 feet beyond the building perimeter, 5 feet beyond primary roadway curbs, walkways, and main utility branch trenches, and 25 feet beyond pervious paving areas that require additional staging areas in order to limit compaction in the paved area; OR, on previously developed sites, restore a minimum of 50% of the remaining open area by planting native or adapted vegetation. **1**

✍✍ Reduce the development footprint (including building, access roads and parking) to exceed the installation/base's/base's master plan local zoning's open space requirement for the site by 25% or in accordance with installation/base policy on open space set asides, whichever is greater. **1**

Technologies /Strategies: Note requirements on plans and in specifications. Establish contractual penalties for destruction of trees and site areas noted for protection. Reduce footprints by tightening program needs and stacking floor plans. Establish clearly marked construction and disturbance boundaries. Delineate laydown, recycling, and disposal areas. Use areas to be paved as staging areas. Work with local horticultural extension services, native plant societies, or installation/base agronomy staff to select indigenous plant species for site restoration and landscaping.

1.C6 Stormwater Management [1]

Intent: Limit disruption of natural water flows by minimizing storm water runoff, increasing on-site infiltration and reducing contaminants.

Requirement: Implement a stormwater management plan that results in:

✍✍ No net increase in the rate or quantity of stormwater runoff from undeveloped to developed conditions; OR, if existing imperviousness is greater than 50%, implement a stormwater management plan that results in a 25% decrease in the rate and quantity of stormwater runoff. **1**

✍✍ Treatment systems designed to remove 80% of the average annual post development total suspended solids (TSS), and 40% of the average annual post development total phosphorous (TP), by implementing Best Management Practices (BMPs) outlined in EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters (EPA-840-B-92-002 1/93). **1**

Technologies /Strategies: Significantly reduce impervious surfaces, maximize on-site stormwater infiltration, and retain pervious and vegetated areas. Capture rainwater from impervious areas of the building for groundwater recharge or reuse within building. Use green/vegetated roofs. Utilize biologically-based and innovative stormwater management features for pollutant load reduction such as constructed wetlands, stormwater filtering systems, bioswales, bio-retention basins, and vegetated filter strips. Use open vegetated swales to reduce drainage velocity and erosion, reduce system maintenance, increase vegetative variety and support wildlife habitat where space permits.

1.C7 Landscape and Exterior Design to Reduce Heat Islands [2]

Intent: Reduce heat islands (thermal gradient differences between developed and undeveloped areas) to minimize impact on microclimate and human and wildlife habitat.

Requirement:

✍✍ Provide shade (within 5 years) on at least 30% of non-roof impervious surface on the site, including parking lots, walkways, plazas, etc., OR, use light-colored/ high-albedo materials (reflectance of at least 0.3) for 30% of the site's non-roof impervious surfaces, OR place a minimum of 50% of parking space under-ground OR use open-grid pavement system (net impervious area of LESS than 50%) for a minimum of 50% of the parking lot area. **1**

✍✍ Use ENERGY STAR Roof compliant, high-reflectance AND low emissivity roofing (initial reflectance of at least .65 and three-year-aged reflectance of at least .5 when tested in accordance with ASTM E408) for a minimum of 75% of the roof surface; OR, install a "green" (vegetated) roof for at least 50% of the roof area. **1**

Technologies /Strategies: Employ design strategies, materials, and landscaping designs that reduce heat absorption of exterior materials. Note albedo/reflectance requirements in the drawings and specifications. Provide shade (calculated on June 21, noon solar time) using native or climate tolerant trees and large shrubs, vegetated trellises, or other exterior structures supporting vegetation. Substitute vegetated surfaces for hard surfaces. Explore elimination of blacktop and the use of new coatings and integral colorants for asphalt to achieve light colored surfaces.

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1.0 Sustainable Sites (Continued)

1.C8 Light Pollution Reduction [1]

Intent: Eliminate light trespass from the building site, improve night sky access, and reduce development impact on nocturnal environments.

Requirement:
- ✍✍ Do not exceed Illuminating Engineering Society of North America (IESNA) footcandle level requirements as stated in the Recommended Practice Manual: Lighting for Exterior Environments, AND design interior and exterior lighting such that zero direct-beam illumination leaves the building site. **1**

Technologies /Strategies: Consult IESNA Recommended Practice Manual: Lighting for Exterior Environments for Commission Internationle de I'Eclairage (CIE) zone and pre and post curfew hour descriptions and associated ambient lighting level requirements. Ambient lighting for pre-curfew hours for CIE zones range between .01 footcandles for areas with dark landscapes such as parks, rural, and residential areas, and 1.5 footcandles for areas with high ambient brightness such as installation/base areas with high levels of nighttime activity. Design site lighting and select lighting styles and technologies to have a minimal impact off-site and minimal contribution to sky glow. Minimize lighting of architectural and landscape features. Exterior lighting should be consistent with security lighting requirements.

1.C9 Optimize Site Features

Intent: Optimize utilization of the site's existing natural features and placement of man-made features on the site.

Requirement:
- ✍✍ Perform both of the following: **1**
  - ✍ Maximize the use of free site energy.
  - ✍ Plan facility, parking and roadways to "fit" existing site contours and limit cut and fill.

Technologies /Strategies: Evaluate site resources to ascertain how each can enhance the proposed project and visa versa. Work to maximum advantage of the site's solar and wind attributes. Use landscaping to optimize solar and wind conditions and to contribute to energy efficiency; Locate and orient the facility on the site to optimize solar and wind conditions.

1.C10 Facility Impact

Intent: Minimize negative impacts on the site and on neighboring properties and structures; avoid or mitigate excessive noise, shading on green spaces, additional traffic, obscuring significant views, etc.

Requirement:
- ✍✍ Cluster facilities to reduce impact, access distance to utilities and sufficient occupant density to support mass transit. **1**
- ✍✍ Collaborate with installation/base and community planners to identify and mitigate potential impacts of the project beyond site boundaries, and transportation planners to insure efficient public transport. **1**

Technologies /Strategies: Involve local/regional planners and community members in installation/base master planning processes. Recognize the context and the impact of a project beyond site boundaries, and integrate it with the larger installation/base/community context/land use.

1.C11 Site Ecology

Intent: Identify and mitigate all existing site problems including contamination of soil, water, and air, as well as any negative impacts caused by noise, eyesores, or lack of vegetation, enhancing or creating new site habitat.

Requirement:
- ✍✍ Develop site environmental management and mitigation plan. **1**

Technologies /Strategies: Understand site and surrounding ecosystem interdependence and interconnectivity. Plan landscaping scheme to incorporate biodiversity. Preserve/enhance existing trees, hydrological features, ecosystems, habitats, and cultural resources. Increase the existence of healthy habitat for native species. Reintroduce native plants and trees where they have been destroyed by previous development.

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

2.0 Water Efficiency — Score 5

2.C1 Water Efficient Landscaping [2]

Intent: Limit or eliminate the use of potable water for landscape irrigation.

Requirement:

- ✍✍ Use high efficiency irrigation technology, OR, use captured rain or recycled site water to reduce potable water consumption for irrigation by 50% over conventional means. **1**
- ✍✍ Use only captured rain or recycled site water for an additional 50% reduction (100% total reduction) of potable water for site irrigation needs, OR, do not install permanent landscape irrigation systems. **1**

Technologies /Strategies: Develop a landscaping water use baseline according to the methodology outlined in the LEED Reference Guide. Specify water-efficient, native or adapted, climate tolerant plantings. High efficiency irrigation technologies include micro irrigation, moisture sensors, or weather data based controllers. Feed irrigation systems with captured rainwater, gray water, or on-site treated wastewater.

2.C2 Innovative Wastewater Technologies [2]

Intent: Reduce generation of wastewater and potable water demand, while increasing local aquifer recharge.

Requirement:

- ✍✍ Reduce the use of municipally provided potable water for building sewage conveyance by a minimum of 50%, OR, treat 100% of wastewater on site to tertiary standards. **1**

Technologies /Strategies: Develop a wastewater baseline according to the methodology outlined in the LEED Reference Guide. Implement decentralized on-site wastewater treatment and reuse systems. Decrease the use of potable water for sewage conveyance by utilizing gray and/or black water systems. Non-potable reuse opportunities include, toilet flushing, landscape irrigation, etc. Provide advanced wastewater treatment after use by employing innovative, ecological, on-site technologies including constructed wetlands, a mechanical recirculating sand filter, or aerobic treatment systems.

2.C3 Water Use Reduction [1]

Intent: Maximize water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.

Requirement:

- ✍✍ Employ strategies that in aggregate use 20% less water than the water use baseline calculated for the building (not including irrigation) after meeting Energy Policy Act (EPACT) of 1992 fixture performance requirements. **1**
- ✍✍ Exceed the potable water use reduction by an additional 10% (30% total efficiency increase). **1**

Technologies /Strategies: Develop a water use baseline including all water consuming fixtures, equipment, and seasonal conditions according to methodology guidance outlined in the LEED Reference Guide. Specify water conserving plumbing fixtures that exceed Energy Policy Act (EPACT) of 1992 fixture requirements in combination with ultra high efficiency or dry fixture and control technologies. Specify high water efficiency equipment (dishwashers, laundry, cooling towers, etc.). Use alternatives to potable water for sewage transport water. Use recycled or storm water for HVAC/process make up water. Install cooling tower systems designed to minimize water consumption from drift, evaporation and blowdown.

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[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

3.0 Energy and Atmosphere — Score 28

3.R1 Fundamental Building Systems Commissioning [1] — Reqd.

Intent: Verify and ensure that fundamental building elements and systems are designed, installed and calibrated to operate as intended.

Requirement: ✍✍ Implement all of the following fundamental best practice commissioning procedures.

- ✍ Engage a commissioning authority.
- ✍ Develop design intent and basis of design documentation.
- ✍ Include commissioning requirements in the construction documents.
- ✍ Develop and utilize a commissioning plan.
- ✍ Verify installation, functional performance, training and documentation.
- ✍ Complete a commissioning report.

Technologies /Strategies: Introduce standards and strategies into the design process early, and then carry through selected measures by clearly stating target requirements in the construction documents. Tie contractor final payments to documented system performance. Perform additional commissioning in accordance with the DOE Building Commissioning Guide, Version 2.2. Refer to the LEED Reference Guide for detailed descriptions of required elements and references to additional commissioning guides. Specify pre-occupancy baseline IAQ testing at time of commissioning. Test for indoor air concentrations of CO, CO2, total VOCs and particulates. Test to assure that adequate ventilation rates have been achieved prior to initial occupancy.

3.R2 Minimum Energy Performance [1] — Reqd.

Intent: Establish the minimum level of energy efficiency for the base building and systems.

Requirement: ✍✍ Design to meet building energy efficiency and performance as required by TI 800-01 (Design Criteria).

Technologies /Strategies: Use building modeling and analysis techniques to establish and document compliance. ASHRAE/IESNA 90.1-1999 provides guidance for establishing building base case development and analysis. Refer to the LEED Reference Guide for a wide variety of energy efficiency strategy resources.

Use a professionally recognized and proven computer program or programs that integrate architectural features with air-conditioning, heating, lighting, and other energy producing or consuming systems. These programs will be capable of simulating the features, systems, and thermal loads used in the design. Using established weather data files, the program will perform 8760 hourly calculations. BLAST, DOE-2 or EnergyPlus are acceptable programs for these purposes.

3.R3 CFC Reduction in HVAC&R Equipment [2] — Reqd.

Intent: Reduce ozone depletion.

Requirement: ✍✍ Zero use of CFC-based refrigerants in new base building HVAC&R systems. When reusing existing base building HVAC equipment, complete a comprehensive CFC phaseout conversion.

Technologies /Strategies: Specify only non-CFC-based refrigerants in all base building HVAC&R systems.

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3.0 Energy and Atmosphere (Continued)

3.C1 Optimize Energy Performance [1]

Intent: Achieve increasing levels of energy performance above the prerequisite standard to reduce environmental impacts associated with excessive energy use.

Requirement:

- ✍✍ Reduce design energy usage (DEU) compared to the energy use budget (EUB) in joules per square meter per year for regulated energy components as described in the requirements of Chapter 11 of the TI 800-01 (Design Criteria), as demonstrated by a whole building simulation. **20**
  - ✍✍ 1 Point will be awarded for every reduction in design energy use of 2.5% for both new and existing facilities for a maximum score of 20 points.

Regulated energy components include HVAC systems, building envelope, service hot water systems, lighting and other regulated systems as defined by ASHRAE.

Technologies /Strategies: Develop and use building modeling and analysis techniques to establish a base case that meets the minimum prerequisite standard. ASHRAE/IESNA 90.1-1999 provides guidance for establishing building base case development and analysis. Perform interactive energy use analysis for selected design elements that affect energy performance and document compliance.

Unit of measure for performance shall be annual energy usage in joules per square meter. Life-Cycle energy costs shall be determined using rates for purchased energy, such as electricity, gas, oil, propane, steam, and chilled water and approved by the adopting authority. Refer to the LEED Reference Guide or Whole Building Design Guide for a wide variety of energy efficiency resources and strategies including conservation measures, electromechanical energy efficiency technologies (for example ground-source heat pumps), passive heating and cooling strategies, solar hot water, and daylighting.

Life-Cycle costing will be done in accordance with 10 CFR 436.

Consider installation of an Energy Management and Control System (EMCS), which is compatible with exiting installation systems to optimize performance. Use sensors to control loads based on occupancy, schedule and/or the availability of natural resources use (day light or natural ventilation).

3.C2 Renewable Energy [1]

Intent: Encourage and recognize increasing levels of self-supply through renewable technologies to reduce environmental impacts associated with fossil fuel energy use.

Requirement:

- ✍✍ Supply a net fraction of the building's total energy use through the use of on-site renewable energy systems.

% of Total Annual Energy Usage in Renewables	
5%	**1**
10%	**2**
15%	**3**
20%	**4**

Technologies /Strategies: Employ the use of on-site non-polluting-source renewable technologies contributing to the total energy requirements of the project. Consider and use high temperature solar and/or geothermal, photovoltaics, wind, biomass (other than unsustainably harvested wood), and bio-gas. Passive solar, solar hot water heating, ground-source heat pumps, and daylighting do not qualify for points under this credit. Credit for these strategies is given in Energy & Atmosphere Credit 1: Optimizing Energy Performance.

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

3.C3 Additional Commissioning [2]

Intent: Verify and ensure that the entire building is designed, constructed, and calibrated to operate as intended.

Requirement: ✍✍ In addition to the Fundamental Building Commissioning prerequisite, implement the following additional commissioning tasks: **1**

1. Conduct a focused review of the design prior to the construction documents phase.
2. Conduct a focused review of the construction documents when close to completion.
3. Conduct a selective review of contractor submittals of commissioned equipment.
4. Develop a system and energy management manual.
5. Have a contract in place for a near-warranty end or post occupancy review.

Items 1, 2, and 3 must be performed by someone other than the designer.

Technologies /Strategies: Introduce standards and strategies into the design process early, and then carry through selected measures by clearly stating target requirements in the construction documents. Tie contractor final payments to documented system performance. Refer to the LEED Reference Guide for detailed descriptions of required elements and references to additional guidelines.

3.C4 << Deleted >> [1]

3.C5 Measurement and Verification [1]

Intent: Provide for the ongoing accountability and optimization of building energy and water consumption performance over time.

Requirement: ✍✍ Comply with the installed equipment requirements for continuous metering as stated in selected Measurement and Verification Methods - Option B: Retrofit Isolation of the US DOE's International Performance Measurement and Verification Protocol (IPMVP) for the following: **1**

- ✍ Lighting systems and controls.
- ✍ Constant and variable motor loads.
- ✍ Variable frequency drive (VFD) operation.
- ✍ Chiller efficiency at variable loads (kW/ton).
- ✍ Cooling load.
- ✍ Air and water economizer and heat recovery cycles.
- ✍ Air distribution static pressures and ventilation air volumes.
- ✍ Boiler efficiencies.
- ✍ Building specific process energy efficiency systems and equipment.
- ✍ Indoor water risers and outdoor irrigation systems.

Technologies /Strategies: Design and specify equipment to be installed in base building systems to allow for comparison, management, and optimization of actual vs. estimated energy and water performance. Employ building automation systems to perform M&V functions where applicable. Tie contractor final payments to documented M&V system performance and include in the commissioning report. Provide for ongoing M&V system maintenance and operating plan in building operations and maintenance manuals. Consider installation/base of an Energy Management and Control System (EMCS), which is compatible with exiting installation/base systems to optimize performance.

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[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

3.C6 Green Power [1]

Intent: Encourage the development and use of grid-source, renewable energy technologies on a net zero pollution basis.

Requirement: ✍✍ Engage in a two year contract to purchase the amount of power equal to projected building consumption generated from renewable sources that meet the Center for Resource Solutions (CRS) Green-E requirements. **1**

Technologies /Strategies: Purchase power from a provider that guarantees a fraction of its delivered electric power is from net nonpolluting renewable technologies. Begin by contacting local utility companies. If the project is in an open market state, investigate Green Power and Power Marketers licensed to provide power in that state. Grid power that qualifies for this credit originates from solar, wind, geothermal, biomass, or low-impact hydro sources. Low-impact hydro shall comply with the Low Impact Hydropower Certification Program.

3.C7 Distributed Generation

Intent: Encourage the development and use of distributed generation technologies, which are less polluting than grid-source energy.

Requirement: ✍✍ Reduce total energy usage and emissions by considering source energy implications and local cogeneration and direct energy conversion. Generate at least 50% of the building's projected annual consumption by on-site distributed generation sources. **1**

Technologies /Strategies: Investigate the use of integrated generation and delivery systems, such as co-generation, fuel cells, micro-turbines and off-peak thermal storage.

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

4.0 Materials and Resources — Score 13

4.R1 Storage & Collection of Recyclables [1] — Reqd.

Intent: Facilitate the reduction of waste generated by building occupants that is hauled to and disposed of in landfills.

Requirement:
- ✍✍ Provide an easily accessible area that serves the entire building that is dedicated to the separation, collection and storage of materials for recycling including (at a minimum) paper, glass, plastics, and metals.

Technologies /Strategies: Establish a waste management plan which meets requirements of the installation/base environmental and/or solid waste management plans in cooperation with users to encourage recycling. Reserve space for recycling functions early in the building occupancy programming process and show areas dedicated to collection of recycled materials on space utilization plans. Broader recycling support space considerations should allow for collection and storage of the required elements and newspaper, organic waste (food and soiled paper), and dry waste. When collection bins are used, bin(s) should be able to accommodate a 75% diversion rate and be easily accessible to custodial staff and recycling collection workers. Consider bin designs that allow for easy cleaning to avoid health issues.

4.C1 Building Reuse [1]

Intent: Extend the life cycle of existing building stock, conserve resources, retain cultural resources, reduce waste, and reduce environmental impacts of new buildings as they relate to materials manufacturing and transport.

Requirement: Reuse large portions of existing structures during renovation or redevelopment projects.

- ✍✍ Maintain at least 75% of existing building structure and shell (exterior skin and framing excluding window assemblies). **1**
- ✍✍ Maintain an additional 25% (100% total) of existing building structure and shell (exterior skin and framing excluding window assemblies). **1**
- ✍✍ Maintain 100% of existing building structure and shell AND 50% non-shell (walls, floor coverings, and ceiling systems). **1**

Technologies /Strategies: Evaluate retention of existing structure. Consider facade preservation, particularly in installation/base areas. During programming and space planning, consider adjusting needs and occupant use patterns to fit within existing building structure and interior partition configurations. Identify and effectively address energy, structural, and indoor environmental (lead & asbestos) issues in building reuse planning and deconstruction documents. Percentage of reused non-shell building portions will be calculated as the total area (s.f.) of reused walls, floor covering, and ceiling systems, divided by the existing total area (s.f.) of walls, floor covering, and ceiling systems.

4.C2 Construction Waste Management [1]

Intent: Divert construction, demolition, and land clearing debris from landfill disposal. Redirect recyclable material back to the manufacturing process.

Requirement: Develop and implement a waste management plan, quantifying material diversion by weight:

- ✍✍ Recycle and/or salvage at least 50% (by weight) of construction, demolition, and land clearing waste. **1**
- ✍✍ Recycle and/or salvage an additional 25% (75% total by weight) of the construction, demolition, and land clearing debris. **1**

Technologies /Strategies: Develop and specify a waste management plan which meets requirements of the installation/base environmental and/or solid waste management plans that identifies licensed haulers and processors of recyclables; identifies markets for salvaged materials; employs deconstruction, salvage, and recycling strategies and processes, includes waste auditing; and documents the cost for recycling, salvaging, and reusing materials. Source reduction on the job site should be an integral part of the plan.

The plan should address recycling of corrugated cardboard, metals, concrete brick, asphalt, land clearing debris (if applicable), beverage containers, clean dimensional wood, plastic, glass, gypsum board, and carpet; evaluate the cost-effectiveness of recycling rigid insulation, engineered wood products and other materials; hazardous materials storage and management; and participation in manufacturers' "take-back" programs to the maximum extent possible. Refer to the LEED Reference Guide for guidelines and references that provide waste management plan development and implementation support including model bid specifications.

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[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

4.C3 Resource Reuse [2]

Intent: Extend the life cycle of targeted building materials, reducing environmental impacts related to materials manufacturing and transport.

Requirement:
- ✍✍ Specify salvaged or refurbished materials for 5% of building materials. **1**
- ✍✍ Specify salvaged or refurbished materials for 10% of building materials. **1**

Technologies /Strategies: Commonly salvaged building materials include wood flooring/ paneling/cabinets, doors and frames, mantels, iron work and decorative lighting fixtures, brick, masonry and heavy timbers. See the LEED Reference Guide for calculation tools and guidelines. Determine percentages in terms of dollar value using the following steps:

1. Calculate total dollars* (see exclusions) of the salvaged or refurbished material.
2. Calculate total dollars (see exclusions) of all building materials.
3. Divide Step 1 by Step 2 to determine the percentage.

Exclusions: In total dollar calculations, exclude; labor costs; all mechanical and electrical material and labor costs; and project overhead and fees. *If the cost of the salvaged or refurbished material is below market value, use replacement cost to estimate the material value, otherwise use actual cost to the project.

4.C4 Recycled Content [1]

Intent: Increase demand for building products that have incorporated recycled content material, reducing the impacts resulting from extraction of new material.

Requirement:
- ✍✍ Specify a minimum of 25% of building materials that contain in aggregate a minimum weighted average of 20% post-consumer recycled content material, OR, a minimum weighted average of 40% post-industrial recycled content material. **1**
- ✍✍ Specify an additional 25% (50% total) of building materials that contain in aggregate, a minimum weighted average of 20% post consumer recycled content material, OR, a minimum weighted average of 40% post-industrial recycled content material. **1**

Technologies /Strategies: Specify building materials containing recycled content for a fraction of total building materials. Select products and materials with supporting information from the AIA Resource Guide or the EPA Environmentally Preferable Purchasing (EPP) Program. Common building materials and products with recycled content include; wall, partition, and ceiling materials and systems; insulation; tiles and carpets; cement, concrete, and reinforcing metals; structural and framing steel. For products/materials not listed, selection should be made on the basis of EPP criterion and/or:

- ✍ Toxicity;
- ✍ Embodied energy;
- ✍ Production use of water, energy and ozone depleting substances (ODSs);
- ✍ Production limits on toxic emissions and effluents;
- ✍ Minimal, reusable or recycled/recyclable packaging;
- ✍ Impact on indoor environmental quality (IEQ);
- ✍ Installation that limits generation of waste;
- ✍ Materials that limit waste generation over their life;
- ✍ EPA guideline compliance; and
- ✍ Harvested on a sustainable yield basis.

See the LEED Reference Guide for a summary of the EPA guidelines and calculation methodology guidelines. Determine percentages in terms of dollar value using the following steps:

1. Calculate total dollars (see exclusions) of the material that contain recycled content.
2. Calculate total dollars (see exclusions) of all building materials.
3. Divide Step 1 by Step 2 to determine the percentage.

Exclusions: Labor costs; all mechanical and electrical material and labor costs; project overhead and fees)

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4.C5 Local/Regional Materials [2]

Intent: Increase demand for building products that are manufactured locally, reducing the environmental impacts resulting from transportation, and supporting the local economy.

Requirement:
- ✍✍ Specify a minimum of 20% of building materials that are manufactured regionally within a radius of 500 miles. **1**
- ✍✍ Of these regionally manufactured materials, specify a minimum of 50% that are extracted, harvested, or recovered within 500 miles. **1**

Technologies /Strategies: Specify and install regionally extracted, harvested, and manufactured building materials. Contact the state and local waste management boards for information about regional building materials. See the LEED Reference Guide for calculation methodology guidelines. Determine percentages in terms of dollar value using the following steps:

1. Calculate total dollars (see exclusions) of material that is locally or regionally manufactured.
2. Calculate total dollars (see exclusions) of all building materials.
3. Divide Step 1 by Step 2 to determine the percentage.

Exclusions: Labor costs; all mechanical and electrical material and labor costs; project overhead and fees.

4.C6 Rapidly Renewable Materials [2]

Intent: Reduce the use and depletion of finite raw and long cycle renewable materials by replacing them with rapidly renewable materials.

Requirement:
- ✍✍ Specify rapidly renewable building materials for 5% of total building materials. **1**

Technologies /Strategies: Rapidly renewable resources are those materials that substantially replenish them-selves faster than traditional extraction demand (e.g. planted and harvested in less than a 10 year cycle) and do not result in significant biodiversity loss, increase erosion, air quality impacts, and that are sustainably managed. See the LEED Reference Guide for calculation methodology guidelines. Determine percentages in terms of dollar value using the following steps:

1. Calculate total dollars (see exclusions) of materials that are considered to be rapidly renewable.
2. Calculate total dollars (see exclusions) of all building materials.
3. Divide Step 1 by Step 2 to determine the percentage.

Exclusions: Labor costs; all mechanical and electrical material and labor costs; project overhead and fees.

4.C7 Certified Wood [2]

Intent: Encourage environmentally responsible forest management.

Requirement:
- ✍✍ Use a minimum of 50% of wood-based materials certified in accordance with the Forest Stewardship Council guidelines for wood building components including but not limited to framing, flooring, finishes, furnishings, and non-rented temporary construction applications such as bracing, concrete form work and pedestrian barriers. **1**

Technologies /Strategies: Refer to the Forest Stewardship Council guidelines for wood building components that qualify for compliance to the requirements and incorporate into material selection for the project.

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[2] ? U. S. Green Building Council. Used by permission.

5.0 Indoor Environmental Quality (IEQ) Score 17

5.R1 **Minimum IAQ Performance** [1] **Reqd.**

Intent: Establish minimum IAQ performance to prevent the development of indoor air quality problems in buildings, maintaining the health and well being of the occupants.

Requirement: ✍✍ Meet the minimum requirements of voluntary consensus standard ASHRAE 62-1999, Ventilation for Acceptable Indoor Air Quality and approved Addenda.

Technologies /Strategies: Include proactive design details that will eliminate some of the common causes of indoor air quality problems in buildings. Introduce standards into the design process early. Incorporate references to targets in plans and specifications. Ensure ventilation system outdoor air capacity can meet standards in all modes of operation. Locate building outdoor air intakes (including operable windows) away from potential pollutants/contaminant sources such as sporulating plants (allergens), loading areas, building exhaust fans, cooling towers, sanitary vents, dumpsters, vehicular exhaust, and other sources. Include operational testing in the building commissioning report. Design cooling coil drain pans to ensure complete draining. Include measures to control and mitigate radon buildup in areas where it is prevalent. Limit humidity to a range that minimizes mold growth and promotes respiratory health.

5.R2 **Environmental Tobacco Smoke (ETS) Control** [2] **Reqd.**

Intent: Prevent exposure of building occupants and systems to Environmental Tobacco Smoke (ETS).

Requirement: ✍✍ Zero exposure of nonsmokers to ETS by prohibition of smoking in the building, OR, by providing a designated smoking room designed to effectively contain, capture and remove ETS from the building. At a minimum, the smoking room shall be directly exhausted to the outdoors with no recirculation of ETS-containing air to the non-smoking area of the building, enclosed with impermeable structural deck-to-deck partitions and operated at a negative pressure compared with the surrounding spaces of at least 7 Pa (0.03 inches of water gauge). Performance of smoking rooms shall be verified using tracer gas testing methods as described in ASHRAE Standard 129-1997. Acceptable exposure in non-smoking areas is defined as less than 1% of the tracer gas concentration in the smoking room detectable in the adjoining non-smoking areas. Smoking room testing as described in the ASHRAE Standard 129-1997 is required in the contract documents and critical smoking facility systems testing results must be included in the building commissioning plan and report or as a separate document.

Technologies /Strategies: Prohibit smoking in the building and/or provide designated smoking areas outside the building in locations where ETS cannot reenter the building or ventilation system and away from high building occupant or pedestrian traffic.

5.C1 **IAQ Monitoring** [1]

Intent: Provide capacity for indoor air quality (IAQ) monitoring to sustain long term occupant health and comfort.

Requirement: ✍✍ Install a permanent carbon dioxide (CO_2) monitoring system that provides feedback on space ventilation performance in a form that affords operational adjustments, AND specify initial operational set point parameters that maintain indoor carbon dioxide levels no higher than outdoor levels by more than 530 parts per million at any time. **1**

Technologies /Strategies: Install an independent system or make CO_2 monitoring a function of the building automation system. Situate monitoring locations in areas of the building with high occupant densities and at the ends of the longest runs of the distribution ductwork. Specify that system operation manuals require calibration of all of the sensors per manufacturer recommendations but not less than one year. Include sensor and system operational testing and initial set point adjustment in the commissioning plan and report. Also consider periodic monitoring of carbon monoxide (CO), total volatile organic compounds (TVOCs), and particulates (including PM10).

[1] Adapted material not reviewed or endorsed by U. S. Green Building Council.

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5.C2 Increase Ventilation Effectiveness [2]

Intent: Provide for the effective delivery and mixing of fresh air to building occupants to support their health, safety, and comfort.

Requirement:

✍✍ For mechanically ventilated buildings, design ventilation systems that result in an air change effectiveness (E) greater than or equal to 0.9 as determined by ASHRAE 129-1997. For naturally ventilated spaces demonstrate a distribution and laminar flow pattern that involves not less than 90% of the room or zone area in the direction of air flow for at least 95% of hours of occupancy. **1**

Technologies /Strategies: Employ architectural and HVAC design strategies to increase ventilation effectiveness and prevent short-circuiting of airflow delivery. Techniques available include use of displacement ventilation, low velocity, and laminar flow ventilation (under floor or near floor delivery) and natural ventilation. Operable windows with an architectural strategy for natural ventilation, cross ventilation, or stack effect can be appropriate options with study of inlet areas and locations. See the LEED Reference Guide for compliance methodology guidelines.

5.C3 Construction IAQ Management Plan [2]

Intent: Prevent indoor air quality problems resulting from the construction/renovation process, to sustain long term installer and occupant health and comfort.

Requirement: Develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building as follows:

✍✍ During construction meet or exceed the minimum requirements of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings under Construction, 1995, AND protect stored on-site or installed absorptive materials from moisture damage, AND replace all filtration media immediately prior to occupancy (Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 13 as determined by ASHRAE 52.2-1999). **1**

✍✍ Conduct a minimum two-week building flushout with new filtration media at 100% outside air after construction ends and prior to occupancy, OR, conduct a baseline indoor air quality testing procedure consistent with current EPA protocol for Environmental Requirements, Baseline IAQ and Materials, for the Research Triangle Park Campus, Section 01445. **1**

Technologies /Strategies: Specify containment control strategies including protecting the HVAC system, controlling pollutant sources, interrupting pathways for contamination, enforcing proper housekeeping and coordinating schedules to minimize disruption. Specify the construction sequencing to install absorptive materials after the prescribed dry or cure time of wet finishes to minimize adverse impacts on indoor air quality. Materials directly exposed to moisture through precipitation, plumbing leaks, or condensation from the HVAC system are susceptible to microbial contamination. Absorptive materials to protect and sequence installation include; insulation, carpeting, ceiling tiles, and gypsum products. Appoint an IEQ Manager with owner's authority to inspect IEQ problems and require mitigation as necessary.

5.C4 Low-Emitting Materials [2]

Intent: Reduce the quantity of indoor air contaminants that are odorous or potentially irritating to provide installer and occupant health and comfort.

Requirement: Meet or exceed VOC limits for adhesives, sealants, paints, composite wood products, and carpet systems as follows:

✍✍ Adhesives must meet or exceed the VOC limits of South Coast Air Quality Management District Rule #1168 by, AND all sealants used as a filler must meet or exceed Bay Area Air Resources Board Reg. 8, Rule 51. **1**

✍✍ Paints and coatings must meet or exceed the VOC and chemical component limits of Green Seal requirements. **1**

✍✍ Carpet systems must meet or exceed the Carpet and Rug Institute Green Label Indoor Air Quality Test Program. **1**

✍✍ Composite wood or agrifiber products must contain no added urea-formaldehyde resins. **1**

Technologies /Strategies: Evaluate and preferentially specify materials that are low emitting, non-irritating, nontoxic and chemically inert. Request and evaluate emissions test data from manufacturers for comparative products. Ensure that VOC limits are clearly stated in specifications, in General Conditions, or in each section where adhesives, sealants, coatings, carpets, and composite woods are addressed.

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[2] ? U. S. Green Building Council. Used by permission.

5.C5 Indoor Chemical and Pollutant Source Control [1]

Intent: Avoid exposure of building occupants to potentially hazardous chemicals that adversely impact air quality.

Requirement:
- ✍✍ Design to minimize cross-contamination of regularly occupied areas by chemical pollutants: **1**
  - ✍ Employ permanent entryway systems (grills, grates, etc.) to capture dirt, particulates, etc. from entering the building at all high volume entryways, AND provide areas with structural deck to deck partitions with separate outside exhausting, no air recirculation and negative pressure where chemical use occurs (including housekeeping areas and copying/print rooms), AND provide drains plumbed for appropriate disposal of liquid waste in spaces where water and chemical concentrate mixing occurs.

Technologies /Strategies: Design to physically isolate activities associated with chemical contaminants from other locations in the building, providing dedicated systems to contain and remove chemical pollutants from source emitters at source locations. Applicable measures include eliminating or isolating high hazard areas; designing all housekeeping chemical storage and mixing areas (central storage facilities and janitors closets) to allow for secure product storage; designing copy/fax/printer/printing rooms with structural deck to deck partitions and dedicated exhaust ventilation systems; and including permanent architectural entryway system(s) to catch and hold particles to keep them from entering and contaminating the building interior.

Consider utilization of EPA registered anti-microbial treatments in carpet, textile or vinyl wall coverings, ceiling tiles or paints where microbial contamination is a concern. Utilize “breathable” wall finishes where circumstances require, to reduce moisture build-up and prevent microbial contamination. Minimize selection of fibrous materials, e.g. insulation, carpet and padding and flexible fabrics, whose exposed surfaces when exposed to the air stream or occupied space can contribute significant emissions and absorb and re-emit other contaminants over time.

5.C6 Controllability of Systems [2]

Intent: Provide a high level of individual occupant control of thermal, ventilation, and lighting systems to support optimum health, productivity, and comfort conditions.

Requirement:
- ✍✍ Provide a minimum of one operable window and one lighting control zone per 200 s.f. for all occupied areas within 15 feet of the perimeter wall. **1**
- ✍✍ Provide controls for each individual for airflow, temperature, and lighting for 50% of the non perimeter, regularly occupied areas. **1**

Technologies /Strategies: Provide individual or integrated controls systems that control lighting, airflow, and temperature in individual rooms and/or work areas. Consider combinations of ambient and task lighting control and operable windows for perimeter and VAV systems for non perimeter with a 1:1: 2 terminal box to controller to occupant ratio.

5.C7 Thermal Comfort [2]

Intent: Provide for a thermally comfortable environment that supports the productive and healthy performance of the building occupants.

Requirement:
- ✍✍ Comply with ASHRAE Standard 55-1992, Addenda 1995 for thermal comfort standards including humidity control within established ranges per climate zone. **1**
- ✍✍ Install a permanent temperature and humidity monitoring system configured to provide operators control over thermal comfort performance and effectiveness of humidification and/or dehumidification systems in the building. **1**

Technologies /Strategies: Integrated envelope and HVAC system design strategies that achieve thermal comfort conditions based on mean radiant temperature, local air velocity, relative humidity, and air temperature. Install and maintain a temperature and humidity monitoring system for key areas of the building (i.e., at the perimeter, and spaces provided with humidity control). This function can be satisfied by the building automation system. Specify in system operation manuals that all sensors require quarterly calibration. Include criteria verification and system operation in commissioning plan and report.

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[2] ? U. S. Green Building Council. Used by permission.

5.C8 Daylight and Views [2]

Intent: Provide a connection between indoor spaces and the outdoor environment through the introduction of sunlight and views into the occupied areas of the building.

Requirement:

- ✍✍ Achieve a minimum Daylight Factor of 2% (excluding all direct sunlight penetration) in 75% of all space occupied for critical visual tasks, not including copy rooms, storage areas, mechanical, laundry, and other low occupancy support areas. Exceptions include those spaces where tasks would be hindered by the use of daylight or where accomplishing the specific tasks within a space would be enhanced by the direct penetration of sunlight. **1**
- ✍✍ Direct line of sight to vision glazing from 90% of all regularly occupied spaces, not including copy rooms, storage areas, mechanical, laundry, and other low occupancy support areas. **1**

Technologies /Strategies: Implement design strategies to provide access to daylight and views to the outdoors in a glare-free way using exterior sun shading, interior light shelves, and /or window treatments. Orient buildings to maximize daylighting options. Consider shallow or narrow building footprints. Employ courtyards, atriums, clerestory windows, skylights, and light shelves to achieve daylight penetration (from other than direct effect or direct rays from the sun) deep into regularly occupied areas of the building.

5.C9 Acoustic Environment /Noise Control

Intent: Provide appropriate acoustic conditions for user privacy and comfort.

Requirement:

- ✍✍ Minimize environmental noise through appropriate use of insulation, sound-absorbing materials and noise source isolation. **1**

Technologies /Strategies: Evaluate each occupied environment and determine the appropriate layout, materials and furnishings design.

5.C10 Facility In-Use IAQ Management Plan

Intent: Insure the effective management of facility air quality during its life.

Requirement:

- ✍✍ Perform all of the following: **1**
  - ✍ Develop an air quality action plan to include scheduled HVAC system cleaning.
  - ✍ Develop an air quality action plan to include education of occupants and facility managers on indoor pollutants and their roles in preventing them.
  - ✍ Develop an air quality action plan to include permanent monitoring of supply and return air, and ambient air at the fresh air intake, for carbon monoxide (CO), carbon dioxide (CO 2), total volatile organic compounds (TVOCs), and particulates (including PM10).

Technologies /Strategies: Provide action plan for periodic system maintenance, monitoring, occupant/manager training.

[2] ? U. S. Green Building Council. Used by permission.

6.0 Facility Delivery Process — Score 7

6.C1 **Holistic Delivery of Facility**

Intent: Encourage a facility delivery process that actively engages all stakeholders in the design process to deliver a facility that meets all functional requirements while effectively optimizing tradeoffs among sustainability, first costs, life cycle costs and mission requirements.

Requirement:

- ✍✍ Choose team leaders that are experienced in holistic delivery of facilities. **1**
- ✍✍ Train the entire team in the holistic delivery process. The team must include all stakeholders in the facility delivery, including the users, the contracting staff, the construction representatives, project manager, and design/engineering team members. **1**
- ✍✍ Identify project goals and metrics. **1**
- ✍✍ Plan and execute charrettes with team members at critical phases of the facility delivery. **1**
- ✍✍ Identify and resolve tradeoffs among sustainability, first costs, life cycle costs and mission requirements through charrettes and other collaborative processes. **2**
- ✍✍ Document required results for each phase of project deliverables that achieve the project goals and are measurable throughout the facility life span. **1**

Technologies /Strategies:

Develop performance specifications or choose competitive range of products that meet environmental criteria.

Use automated modeling and analysis tools to assess site and facility design alternatives.

Conduct life-cycle cost analysis (LCCA) in the design process according to the Federal Facilities Council Technical Report, Sustainable Federal Facilities: A Guide To Integrating Value Engineering, Life Cycle Costing, and Sustainable Development, FFC # 142, 2000.

Conduct a full ecological assessment to include soil quality, water resources and flows, vegetation and trees, wildlife habitats and corridors, wetlands, and ecologically sensitive areas to identify the least sensitive site areas for development. Evaluate space utilization/functions to reduce overall space requirements, considering networking, flextime, flexi-place, dual-use, and other strategies to reduce space requirements/optimize facility size.

7.0 Current Mission — Score 6

7.C1 Operation and Maintenance

Intent: Encourage the development of a facility delivery process that enhances efficient operation and maintenance of the facility.

Requirement:

- ✍✍ Develop a facility operations and maintenance program to include: **2**
  - ✍ Commissioning instructions for all facility systems.
  - ✍ Comprehensive facility operations and maintenance instructions for system operation, performance verification procedures and results, an equipment inventory, warrantee information, and recommended maintenance schedule. The instructions should include a comprehensive, preventive maintenance program to keep all facility systems functioning as designed.
  - ✍ A periodic training program for occupants, facilities managers, and maintenance staff in all facility operations and maintenance activities.
  - ✍ Instructions on sustainable cleaning and pest control practices.
  - ✍ Develop a comprehensive site/facility recycling/waste management plan.
- ✍✍ Provide surfaces, furnishings, and equipment that are appropriately durable, according to life cycle cost analysis. **1**

Technologies /Strategies:

Maintain facility elements, systems and subsystems on a routine maintenance schedule to ensure integrity and longevity.

Perform scheduled cleaning and maintenance activities with nontoxic environmentally preferable cleaning products and procedures. Keep air ducts clean and free of microorganisms through a structured program of preventive maintenance. Clean lighting systems following a regular maintenance schedule to ensure optimum light output and energy efficiency.

Use pesticides and herbicides sparingly and only when necessary with preference to natural methods and materials over poisons and toxic agents.

Use automated monitors and controls for energy, water, waste, temperature, moisture, and ventilation monitors and controls. Turn off the lights, computers, computer monitors, and equipment when not in use. Enable power-down features on office equipment.

7.C2 Soldier and Workforce Productivity and Retention

Intent: Provide a high-quality, functional, healthy and safe work environment to promote soldier and workforce productivity and retention.

Requirement:

- ✍✍ Provide a high quality indoor environment to enhance user/occupant quality of life (QOL). **1**
- ✍✍ Provide a highly functional work environment to promote user/occupant work productivity. **1**
- ✍✍ Provide a healthy and safe work environment to sustain QOL and productivity. **1**

Technologies /Strategies:

Use a registered/certified interior designer to provide stimulating interior environments with pleasant colors, surface treatments, room proportions and ceiling heights, external views, natural lighting, and quality detailing for interior furnishings, equipment, materials and finishes. Use IES standards to provide light to occupied space with variations in level, comfortable contrasts, natural color rendition, natural/man-made, and adequate controls to optimize light aesthetic qualities. Provide occupant control of individual work areas configuration, and lighting, thermal and ventilation systems.

Collaborate with end users to identify functional and technical requirements and to perform adjacency studies. Configure occupied space to address the specific workers/occupants functions and activities that will be carried out there. Meet TI 800-01 Design Guide requirements. Design and configure occupied space, and select furniture and equipment using human ergonomics. Identify existing user amenities, such as dining, recreation, socialization, shopping and child care facilities. Identify what amenities should be incorporated into the project or provided in the future, nearby facility. Provide ventilation air in sufficient volume free from natural and man made contaminants.

8.0 Future Missions — Score 4

8.C1 Functional Life of Facility and Supporting Systems

Intent: Assess the functional life of a facility and its supporting systems to optimize the infrastructure investment.

Requirement:

- ✍✍ Identify how long the designed function is likely to occupy the current facility. **1**
- ✍✍ Identify how long the envelope, structure, HVAC, plumbing, communications, electrical, and other systems are likely to last before requiring replacement or upgrade. Consider economic, functional and physical obsolescence. **1**

Technologies /Strategies: Assess the typical or likely lifespan of the function(s) to be accommodated to forecast eventual adaptation to a different use(s). Assess the life spans of the various building systems/components to forecast their revision/replacement during the facility lifespan and design in a manner that facilitates revision/replacement.

Consider the life span of the weapon systems, doctrines, or other programs supported by the facility.

Use life cycle data and other sources to identify the life span of the embodied systems.

8.C2 Adaptation, Renewal and Future Uses

Intent: Encourage facility design that is responsive to change over time to maximize accommodation of future uses without creating waste and insuring maximum useful life of products.

Requirement:

- ✍✍ Identify possible future uses for the facility; consider alternatives that expand the list of possible future uses. AND Design the building to accommodate as wide a range of future uses, as practical. AND Design the installation of building systems to accommodate foreseeable change with a minimum amount of disruption, cost, and additional materials. **1**
- ✍✍ Build the smallest facility necessary to meet current mission functional requirements, using the most efficient shape and form, while taking into consideration expansion capabilities and potential future mission requirements. AND Design the facility for recycling of materials and systems. **1**

Technologies /Strategies: Create durable, long-lasting and adaptable facility shell and structural system. Create an adaptable, flexible facility design using open planning, service corridors, interstitial space, access floors, demountable walls/partitions, modular furniture and other adaptable space configuration/utilization strategies.

Select materials that are recyclable, avoiding composite materials, such as reinforced plastics and carpet fibers and backing. Consider selecting materials and labeling construction materials with identification information to facilitate recycling. Use pre-cut/pre-fabricated materials and use standard lengths and sizes (dimensional modularity) in design. Design facility systems and subsystems for reconfiguration and/or disassembly/recycling using reversible/reusable connectors.

Facility Points Summary

1.0	**Sustainable Sites (S)**	**Score**	**0**	**Max 20**
1.R1	✍✍ Erosion, Sedimentation and Water Quality Control			[Required]
1.C1	✍✍ Site Selection			2
1.C2	✍✍ Installation/Base Redevelopment			2
1.C3	✍✍ Brownfield Redevelopment			1
1.C4	✍✍ Alternative Transportation			4
1.C5	✍✍ Reduced Site Disturbance			2
1.C6	✍✍ Stormwater Management			2
1.C7	✍✍ Landscape and Exterior Design to Reduce Heat Islands			2
1.C8	✍✍ Light Pollution Reduction			1
1.C9	✍✍ Optimize Site Features			1
1.C10	✍✍ Facility Impact			2
1.C11	✍✍ Site Ecology			1
2.0	**Water Efficiency (W)**	**Score**	**0**	**Max 5**
2.C1	✍✍ Water Efficient Landscaping			2
2.C2	✍✍ Innovative Wastewater Technologies			1
2.C3	✍✍ Water Use Reduction			2
3.0	**Energy and Atmosphere (E)**	**Score**	**0**	**Max 28**
3.R1	✍✍ Fundamental Building Systems Commissioning			[Required]
3.R2	✍✍ Minimum Energy Performance			[Required]
3.R3	✍✍ CFC Reduction in HVAC&R Equipment			[Required]
3.C1	✍✍ Optimize Energy Performance			20
3.C2	✍✍ Renewable Energy			4
3.C3	✍✍ Additional Commissioning			1
3.C4	✍✍ <<Deleted>>			
3.C5	✍✍ Measurement and Verification			1
3.C6	✍✍ Green Power			1
3.C7	✍✍ Distributed Generation			1
4.0	**Materials and Resources (M)**	**Score**	**0**	**Max 13**
4.R1	✍✍ Storage & Collection of Recyclables			[Required]
4.C1	✍✍ Building Reuse			3
4.C2	✍✍ Construction Waste Management			2
4.C3	✍✍ Resource Reuse			2
4.C4	✍✍ Recycled Content			2
4.C5	✍✍ Local/Regional Materials			2
4.C6	✍✍ Rapidly Renewable Materials			1
4.C7	✍✍ Certified Wood			1
5.0	**Indoor Environmental Quality (IEQ) [Q]**	**Score**	**0**	**Max 17**
5.R1	✍✍ Minimum IAQ Performance			[Required]
5.R2	✍✍ Environmental Tobacco Smoke (ETS) Control			[Required]
5.C1	✍✍ IAQ Monitoring			1
5.C2	✍✍ Increase Ventilation Effectiveness			1
5.C3	✍✍ Construction IAQ Management Plan			2
5.C4	✍✍ Low-Emitting Materials			4
5.C5	✍✍ Indoor Chemical and Pollutant Source Control			1
5.C6	✍✍ Controllability of Systems			2
5.C7	✍✍ Thermal Comfort			2
5.C8	✍✍ Daylight and Views			2
5.C9	✍✍ Acoustic Environment /Noise Control			1
5.C10	✍✍ Facility In-Use IAQ Management Plan			1

Facility Points Summary (Continued)

				Maximum Points
6.0	**Facility Delivery Process (P)**	**Score**	**0**	**Max 7**
6.C1	✍✍ Holistic Delivery of Facility			7
7.0	**Current Mission**	**Score**	**0**	**Max 6**
7.C1	✍✍ Operation and Maintenance			3
7.C2	✍✍ Soldier and Workforce Productivity and Retention			3
8.0	**Future Missions**	**Score**	**0**	**Max 4**
8.C1	✍✍ Functional Life of Facility and Supporting Systems			2
8.C2	✍✍ Adaptation, Renewal and Future Uses			2

Total Score | **0** | **Max 100**

SPiRiT Sustainable Project Certification Levels

SPiRiT Bronze		**25 to 34 Points**
SPiRiT Silver		**35 to 49 Points**
SPiRiT Gold		**50 to 74 Points**
SPiRiT Platinum		**75 to 100 Points**

Project Points of Contact

SPiRiT Comment Sheet

Please forward any comments that you may have on this Sustainable Project Rating Tool, preferably by Email, to:

Mr. Harry Goradia
U. S. Army Corps of Engineers
ATTN: CEMP-ET
441 G Street NW
Washington, DC 20314
Phone (202) 761-7170, FAX (202) 761-0633
Email harry.goradia@hq02.usace.army.mil

SPiRiT Para.

Facility Points Summary

			Max
1.0	**Sustainable Sites (S)**	**0**	**20**
1.R1 *	Erosion, ~~and~~ Sedimentation *and Water Quality* Control		[Reqd]
1.C1 *	Site Selection		2
1.C2 *	*Installation/Base Urban Redevelopment*		2
1.C3 *	Brownfield Redevelopment		1
1.C4 *	Alternative Transportation		4
1.C5 *	Reduced Site Disturbance		2
1.C6 *	Stormwater Management		2
1.C7	Landscape and Exterior Design to Reduce Heat Islands		2
1.C8 *	Light Pollution Reduction		1
1.C9 **	*Optimize Site Features*		1
1.C10 **	*Facility Impact*		2
1.C11 **	*Site Ecology*		1
2.0	**Water Efficiency (W)**	**0**	**5**
2.C1	Water Efficient Landscaping		2
2.C2	Innovative Wastewater Technologies		1
2.C3 *	Water Use Reduction		2
3.0	**Energy and Atmosphere (E)**	**0**	**28**
3.R1 *	Fundamental Building Systems Commissioning		[Reqd]
3.R2 *	Minimum Energy Performance		[Reqd]
3.R3	CFC Reduction in HVAC&R Equipment		[Reqd]
3.C1 *	Optimize Energy Performance		20
3.C2 *	Renewable Energy		4
3.C3	Additional Commissioning		1
3.C4	~~Elimination of HCFC's and Halons~~ <<Deleted>>		
3.C5 *	Measurement and Verification		1
3.C6 *	Green Power		1
3.C7 **	*Distributed Generation*		1
4.0	**Materials and Resources (M)**	**0**	**13**
4.R1 *	Storage & Collection of Recyclables		[Reqd]
4.C1 *	Building Reuse		3
4.C2 *	Construction Waste Management		2
4.C3	Resource Reuse		2
4.C4 *	Recycled Content		2
4.C5	Local/Regional Materials		2
4.C6	Rapidly Renewable Materials		1
4.C7	Certified Wood		1

			Max
5.0	**Indoor Environmental Quality (IEQ) [Q]**	**0**	**17**
5.R1 *	Minimum IAQ Performance		[Reqd]
5.R2	Environmental Tobacco Smoke (ETS) Control		[Reqd]
5.C1 *	*IAQ Carbon Dioxide (CO2) Monitoring*		1
5.C2	Increase Ventilation Effectiveness		1
5.C3	Construction IAQ Management Plan		2
5.C4	Low-Emitting Materials		4
5.C5 *	Indoor Chemical and Pollutant Source Control		1
5.C6	Controllability of Systems		2
5.C7	Thermal Comfort		2
5.C8	Daylight and Views		2
5.C9 **	*Acoustic Environment /Noise Control*		1
5.C10 **	*Facility In-Use IAQ Management Plan*		1
6.0	**Facility Delivery Process (P)**	**0**	**7**
6.C1 **	*Holistic Delivery of Facility*		7
7.0	**Current Mission**	**0**	**6**
7.C1 **	*Operation and Maintenance*		3
7.C2 **	*Soldier and Workforce Productivity and Retention*		3
8.0	**Future Missions**	**0**	**4**
8.C1 **	*Functional Life of Facility and Supporting Systems*		2
8.C2 **	*Adaptation, Renewal and Future Uses*		2
	Total Score	**0**	**100**

SPiRiT Sustainable Project Certification Levels

SPiRiT Bronze		**25-34**
SPiRiT Silver		**34-49**
SPiRiT Gold		**50-74**
SPiRiT Platinum		**75-100**